SCIENTIFIC AMERICAN

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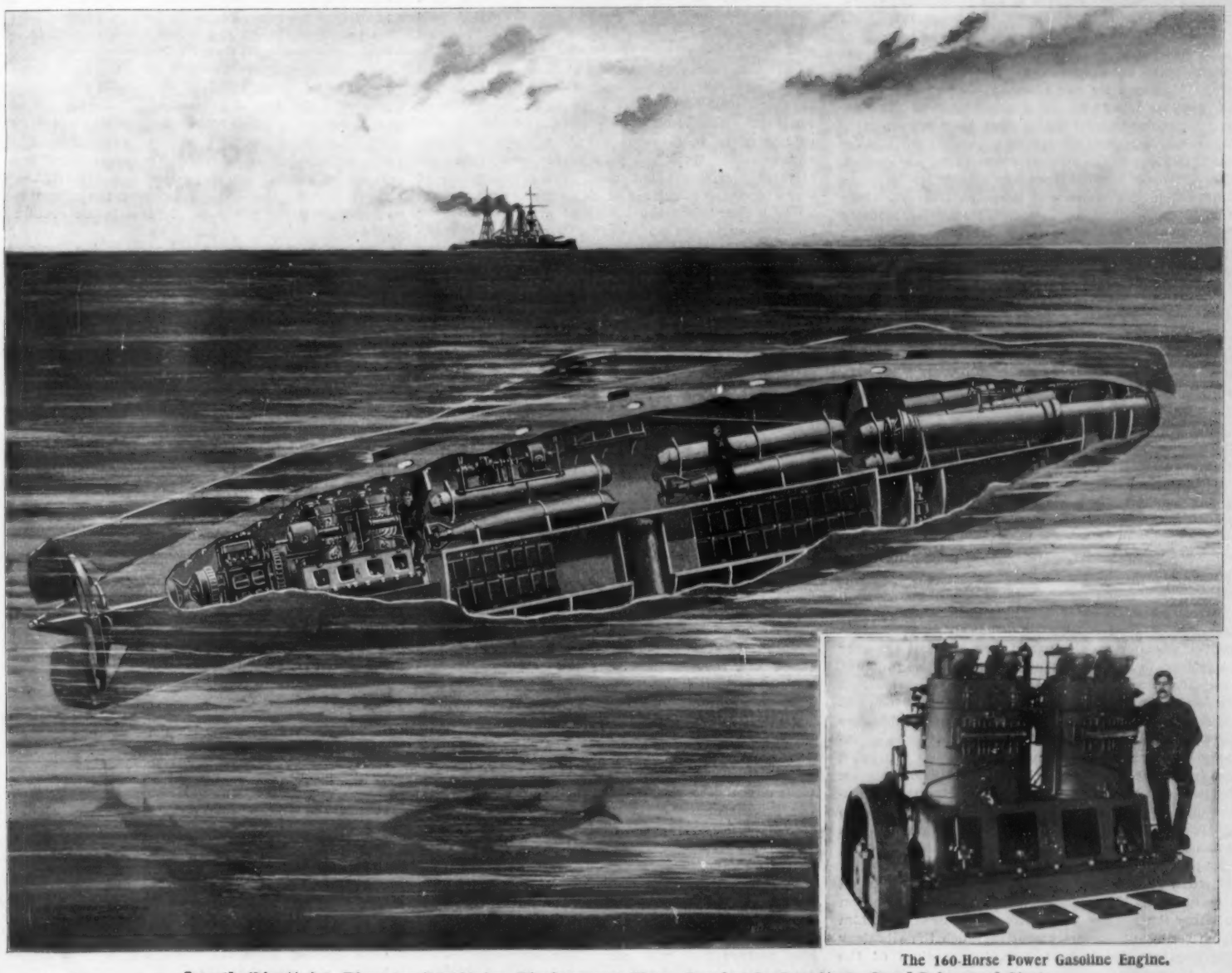
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXXV.—No. 26. ESTABLISHED 1845. | NEW YORK, DECEMBER 28, 1901. | $3.00 A YEAR. 8 CENTS A COPY.

Method of Attack.



The 160-Horse Power Gasoline Engine.

Length, 63 feet 4 inches. **Diameter,** 11 feet 9 inches. **Displacement,** 120 tons. **Speed at Surface,** 8 knots. **Speed Submerged,** 7 knots.

NEW UNITED STATES SUBMARINE TORPEDO BOATS.—[See page 427.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 12s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) ..... $3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Monthly (Established 1885) ..... 2.50 "
Scientific American Export Edition (Established 1878) ..... 5.00 "

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, DECEMBER 28, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

TRANSOCEANIC WIRELESS TELEGRAPHY.

It appears to be pretty generally accepted that Marconi has succeeded in sending across the Atlantic audible signals from his wireless telegraphic station in Cornwall, England, to Signal Hill, Newfoundland—a distance of 1,800 miles. To be sure, the Newfoundland experiments have not been accepted by all scientists as conclusive. English physicists are particularly skeptical. Silvanus P. Thompson, although accepting Marconi's statements, leaves us to infer that success would not have been so easily attained if the letter "V" had been transmitted instead of "S." Prof. Dewar, if he has been correctly quoted, does not believe that the possibility of transmitting signals across the Atlantic has as yet been adequately demonstrated. On the other hand, Mr. Edison accepts the report as authentic, and Prof. Bell has cabled his congratulations and has offered his place on the coast of Nova Scotia as a place for future experiment.

During the International Yacht Races of 1899, held off Sandy Hook, it was the privilege of a representative of the SCIENTIFIC AMERICAN to interview Mr. Marconi, who, at that time, was superintending the sending of wireless reports of the races to The New York Herald. Marconi proved to be a man fully conscious of the possibilities of the new telegraphy with which his name has ever been linked, and yet exceedingly conservative in his opinions. In response to an inquiry from our representative on the future of wireless telegraphy as a competitor of the submarine cable, Marconi stated that he was content to work in the limited field then opened up to him by his invention; but, upon being pressed for an opinion, did not deny his belief in the possibility at some future time of being able to telegraph from one shore to the other. The impression of singular modesty then received has since been strengthened. In no authorized statement has Marconi hitherto exaggerated the results of his investigations. We are therefore inclined to accept his present announcement that he has succeeded in signaling from Europe to America.

If any proof were desired of the importance of the ocean transmission of that first wireless signal it would be found in the trepidation of the Anglo-American Cable Company and its hasty threat to stop all further experiments. It seems that this company has been granted a monopoly for fifty years—a term which expires in 1904—and that by the provisions of its grant it claims that Marconi can be enjoined from transmitting transatlantic messages.

It seems, in fact, that Marconi had acted hastily and probably prematurely in his determination to leave Newfoundland and seek a place of experiment on the mainland. It seems extremely doubtful whether the Anglo-American Cable Company could have enjoined him from continuing his experiments. Of course, very much depends upon the nature of the contract entered into between the company and the government of Newfoundland, but it is a well-accepted principle of the patent law that an inventor is entitled to make use of a patented device, provided it is for purposes of experiment only. Had Marconi perfected his system to such an extent as to place it upon a commercial basis, the conditions would have been far otherwise; but certainly for purposes of experiment it seems as if it would have been a difficult matter to have induced a court of equity to grant an injunction which would prevent his carrying on experiments which are being watched with such intense interest from the four corners of the earth. The Anglo-American Company does not claim to control any patents covering the mechanism employed by Mr. Marconi. So long as he does not land a cable on the coast of Newfoundland, it is a grave question whether it would be possible for them to prevent him from setting up an instrument in which the vibratory impulses are received through the medium of the air. We regret that Marconi did not, in the interests of science, firmly maintain his position and resist to the utmost the selfish demands of the cable company.

APPRECIATION OF THE NAVAL NUMBER.

The warm reception which has been given to our special number describing the growth of the United States navy since the war with Spain, is another evidence that the deep interest in the United States navy which was awakened, or rather re-awakened, during our late war is but very little diminished. At the close of that struggle the fear was expressed that popular interest in naval affairs would pass away, and that the country would return to that attitude of indifference, which left the United States practically without a navy for two whole decades of her history. We are satisfied that the fear was unfounded, for the Editor's mail has brought, in the way of questions and criticisms on naval matters, and requests for more complete information, many more communications than we have found space to print. To us this is one among many indications that the people of the United States have realized how closely the prosperity and security of the country are related to the growth and efficiency of its navy.

It has been the aim of this journal to keep in such close touch with the Navy Department, and with the trend of ideas among the line and staff officers who construct and handle its warships, as to be able to do full justice to the best features of our naval work, without falling into the all-too-common error of using only superlative terms in speaking of the ships which are such an object of pride to all American citizens. In view of the fact that we have not hesitated to criticise where we thought criticism was due, we are particularly pleased with the many unsolicited letters of congratulation which we have received from high officials in the United States navy. Speaking of the Naval Number, the present Chief of one of the Naval Bureaus writes: "It is not only intensely interesting, but is beautifully prepared, and better than all, is correct;" while a former Chief of the Bureau of Ordnance says: "You are doing a great work for the navy. No other paper approaches your literary work on the service."

BRIDGES VERSUS TUNNELS.

The decision of the Pennsylvania Railroad to connect its lines in New Jersey and Long Island with one another and with New York by tunnels rather than by bridges was natural, and, we had almost said, inevitable. There is to-day a growing tendency in all the great centers of population to place the means of transportation underground, and this for the very good reason that there is no further room for them above ground. In an earlier day it was customary to build rapid transit systems, and the approaches of trunk railroads in the great cities, on elevated structures; but the growing congestion of street traffic, vehicular and pedestrian, has brought us to a time when the piers and arches of steel or stone viaducts are no longer a permissible obstruction, to say nothing of objections on the score of the obtrusive ugliness of such structures. Hence we have been driven below ground, and the tunnel, thanks to electric lighting and traction, has proved to be a cleanly and comfortable substitute for the overhead structure.

To the engineer, and, indeed, to all of us who are attracted by engineering works of great daring and magnitude, it will be something of a disappointment that the proposed Hudson River bridge, with its vast 3,000-foot span and its towers reaching five hundred feet into the air, will not be built; but now that a great railroad company like the Pennsylvania has openly declared in favor of tunnels as the best method of serving New York with due regard to its own interest and the convenience of the city itself, we may take it for granted that the Hudson River bridge will never be built.

In justice to the proposed bridge, however, a word should be spoken in contradiction of the popular impression that a bridge would be a far more costly undertaking than tunnels. While it is true that the proposed two-tunnel scheme, shown elsewhere in this issue, will cost far less than the proposed Twenty-third Street bridge, we must remember that its capacity will be only one-sixth as great; for in designing his bridge Mr. Lindenthal proportioned it for the accommodation of no less than twelve separate railroad tracks, eight on the lower and, if required, four on the upper deck. Hence the proper basis of comparison would be that of twelve 18-foot tunnels against one bridge; and no doubt the bridge would work out in spite of greater real estate cost, as costing less than the twelve tunnels. The bridge, however, being exposed to the elements would be more expensive in maintenance. Moreover, unlike the tunnels, once the river was crossed a bridge would involve the erection of a vast viaduct and surface station that would seriously incumber our already overcrowded streets. The feature that will, more than any other, commend this tunnel scheme to our municipal authorities and to the people of New York is that it will be absolutely unobtrusive.

ANNUAL REPORT OF THE WORK OF THE OBSERVATORY OF PARIS FOR 1900.

BY M. LOEWY, DIRECTOR. ABSTRACTED BY OUR PARIS CORRESPONDENT.

The past year has been an especially busy one for the Observatory, as it was necessary to make a proper showing at the exposition and to present a visible image of the work carried on and the progress obtained by the institution. Besides this, a number of events have occurred which have brought on new series of researches. The efforts of the director were especially engaged in organizing the International Astrophotographic Congress of 1900. This congress, owing to different circumstances, had an exceptional importance. It was necessary to assure the definite success of the map of the heavens, a work which has been in execution for twelve years, also to undertake one of the great problems of astronomy, the determination of the solar parallax, which it was hoped to solve with a precision unobtainable in the past owing to the discovery of the planet Eros, which comes so near the earth at certain epochs. The congress was held at the Observatory from the 19th to the 26th of July. In that short time, owing to the authority of the scientists who took part in it, the work has been most fruitful and important decisions were made, which will leave a durable trace in the history of astronomy. Concerning the photographic map of the heavens, the main object of discussion was the filling up of some of the gaps in the exploration of the heavens in certain regions of the southern hemisphere. Three of the observatories charged with the work of these zones had not been able to carry out the work. The efforts of the congress to better the situation have resulted favorably, and Mr. Thoma, Director of the Cordoba Observatory (Argentine) promised his aid on behalf of the government. Again Mr. Cooke, Director of the Perth Observatory (West Australia) is to take a share of the work, as the necessary subsidies have been obtained owing to the efforts of the congress. Lastly, M. Enrique Legrand is taking measures to have his government establish a special observatory at Montevideo (Uruguay) for this work. The importance of the map of the heavens seems to increase continually and it promises scientific results which have not been foreseen. Some late researches made by Mr. H. H. Turner, Director of the Oxford Observatory, prove that the map, which will contain millions of stars, will render results which we have scarcely ventured to hope for. Owing to a rectangular ruling which is superposed photographically upon the map, it is possible to take the positions of a multitude of stars with a precision comparable with the direct meridian observations. Photography thus enables us to accomplish a great work which would be almost impossible by direct observation, as it would take the united efforts of the astronomers of the world for hundreds of years before coming to an end.

To finish the task imposed upon it the Paris congress was obliged to establish an agreement concerning the determination of the solar parallax. This problem had been considerably discussed, and some eminent astronomers thought that the time had not yet come for its solution. It was under this difference of opinion that the congress deliberated as to whether a systematic observation of the planet Eros in different parts of the globe should be made to determine the parallax. The congress appointed a special commission of ten prominent astronomers to study the question, and it was decided to take up the work. As the observations had to be commenced at once, a series of tables and instructions was quickly prepared and sent out, so as to secure the co-operation of the observatories scattered over the globe and to render the publication of the results homogeneous and precise. As many as 58 observatories engaged themselves in the new enterprise, as follows: Abbadia, Algiers, Athens, Bamberg, Berlin, Besançon, Bordeaux, Cambridge (Eng.), Cambridge (U. S.), Cape of Good Hope, Catania, Kharkov, Charlottesville, Christiania, Copenhagen, Cordoba, Denver, Dublin, Düsseldorf, Edinburgh, Evanston, Flagstaff, Florence, Greenwich, Heidelberg, Helsingfors, Kasan, Königsberg, Leyden, Leipzig, Lisbon, Lyons, Madison, Marseilles, Minneapolis, Mt. Hamilton, New York, Nice, Northfield, Oxford, Padua, Palermo, Paris, Potsdam, Pulkovo, Rome, San Fernando, Strasburg, Tachkent, Tacubaya, Teramo, Toulouse, Uccle (Belgium), Upsala, Vienna (2 observatories), Washington, Williams Bay. The work only commenced in the first part of October, and from that time to the first of January, when complete details had been obtained from 20 observatories, it was found that in spite of the bad weather not a day had passed in which the planet was not observed by one or other of the prescribed methods. This numerous series of observations permits of obtaining the parallax with great precision, and these results will be more than doubled when the remaining work is finished. It may be remarked that this international project

offers a fine example of the disinterestedness and solidarity of those who collaborated in this work, which includes nearly 60 observatories.

As regards the work at Paris for the year, nearly all the resources of the observatory have been devoted to publishing the fourth part of the star catalogue, as it became urgent to render accessible to scientists the last part of the numerous observations made at Paris up to 1881, which had not been heretofore published in complete form. This great work, which has been in execution for twenty years, is now nearly finished. Of 430 plates composing the 48 volumes of the star catalogue, only 30 remain to be published. Again, an important series of meridian observations have been made for the solar parallax with three groups of instruments, and thus the exact position of 670 stars has been taken, between the 7th and the 9th magnitude, placed symmetrically on each side of the path of Eros at 1 deg. distance, so that whatever be the photograph taken of the planet with the other instruments, the image of about a dozen of these stars will always be found on the plate, and serve as locating points. Eighteen observatories, including Paris, have undertaken the work of obtaining the exact position of these stars, so that it is possible to calculate exactly the position of all the stars photographed upon the plates. This work, which is so essential for the solar parallax, is now completed.

The exploration of the heavens for the photographic star map has been continued under the best conditions by Messrs. Prosper and Paul Henry up to the beginning of October, 1900, and afterward they have especially made photographic observations of Eros. Between the 3d of October and the 31st of December, 367 planetary images have been obtained, based on greatly varied exposures, with a view of eliminating errors. During all the favorable nights the operations have commenced at sundown and continued as long as the star was 20 degrees above the horizon. Messrs. Bigourdan and Fayet have been equally active at the equatorial of the West Tower and have determined directly by micrometric measurements the position of Eros relative to the neighboring stars. At the East Tower, Messrs. Callandreau and Schaumasse have made about 44 complete observations in 21 evenings. Thus the Observatory of Paris, owing to the ensemble of its work, has been able to contribute toward the determination of the parallax by a respectable series of observations and studies.

This year the publication of the photographic star catalogue was commenced, and 11 plates containing the rectangular co-ordinates of 16,500 stars have been printed. As to the photographic map of the heavens, the main work, which is to have star-images down to the 14th magnitude, we have been less fortunate, and its publication has been almost completely stopped, mainly from the failure of one of the two heliographic firms. In order to render our publications independent of outside specialists we have studied the process and in the future will carry out a part of it at the observatory and have the rest supervised by our own force. Messrs. Loewy and Puiseux have used the great angle equatorial in the first months of 1900 to prepare the photographs for the exposition and have made some large views of the moon. Two of these, 56 inches in diameter, show the moon near the first and last quarter, and others are enlargements of interesting regions. The photographic atlas of the moon has been delayed owing to the presence of other work, and although the 5th part is entirely prepared, it could not be issued in 1900.

The list of personal researches shows that the activity of the astronomers has not diminished during the last year. The special reports show the details of the progress made in the different branches of work. Among others may be mentioned the two expeditions of Messrs. Bigourdan and Hamy, who were sent to Spain to observe the last total eclipse of the sun.

The new arrangement of the Meridian Circle which is established in the grounds of the observatory is of great interest. By this means M. Renan is enabled to obtain the variations of the instrumental azimuth with great exactness. This element, which is so essential and so difficult to determine in all astronomical establishments, can now be determined at all hours of the day independently of the agitation of the atmospheric layers which separate the eyepiece from the objective. A tube 102 feet long and 30 inches in diameter is now used to unite the two, and the arrangement thus resembles a telescope. The tube is surrounded by a two-inch felt covering, and now gives an almost complete protection from the movements of the air caused by the great variations of temperature throughout the day. Measurements are now made with much greater precision than before, and all astronomers who have seen it consider it a great improvement.

The use of separate cars for children having whooping cough is being advocated in France, where a change of climate is the usual remedy for this disease, and consequently there is much travel among children.

THE HEAVENS IN JANUARY, 1902.

BY HENRY NORRIS RUSSELL, PH.D.

Though the planets which illuminated the autumn skies so brightly are now, all but Venus, lost to view, their absence is fully made up by the appearance of the brilliant winter constellations. At our accustomed hour of 9 P. M., in the middle of this month, Orion is almost due south, about half way up to the zenith. He may be instantly recognized by the familiar "belt," with the bright stars Betelgeuse above and Rigel below. The line of the belt, extended upward to the right, points toward the ruddy Aldebaran and the Pleiades. Extended downward for about the same distance it reaches Sirius, which is about four times as bright as any other star in sight. An irregular cross of stars below it, containing a couple of bright ones, also belongs to the constellation of Canis Major.

Higher than Sirius, and some distance to the left, is Procyon, and still higher are the twin stars Castor and Pollux, with the rest of Gemini. Auriga, directly overhead, is marked by Capella, next to Sirius the brightest star visible. In the east the sickle of Leo has just risen. Between it and Gemini is a little cloud of light—the famous cluster Praesepe—which marks the position of Cancer; and the head of Hydra is rising farther south. Below Orion lie the small constellations Lepus and Columba, and on the right is the extensive but inconspicuous Eridanus.

This classic river is represented by a stream of faint stars, starting near Rigel and running first westward, then southeastward, and then toward the southwest, till it sinks out of sight. It ends in a star—Achernar—almost as bright as Rigel, which is only visible from points south of the latitude of Savannah.

Cetus, which is almost equally extensive, occupies the southwest. Aries is marked by a little triangle of stars west of the zenith. Perseus and Cassiopeia lie in the Milky Way northwest of Auriga. Cygnus, below them, has partly set. Andromeda lies below Perseus and to the left of Cassiopeia, and Pegasus is still lower, its "great square" standing on one corner.

The Little Bear hangs by his tail from the pole-star, inclosed by the coils of the Dragon, while the Great Bear stands upright upon his tail (the dipper-handle) in an equally uncomfortable position.

THE PLANETS.

Mercury is very close to the sun at the first of the year, passing behind him on the night of the 1st, and becoming an evening star. Though he appears so near the sun, or, rather, though he would so appear if we could see him, he is actually farther away behind him than usual. After this he approaches both the sun and the earth, and by the last week of January he should be easily seen just after dark, low in the southwest, as he sets about an hour and a half later than the sun. He is unusually bright, so that the present opportunity for seeing him is decidedly favorable. On the evening of the 23d he is in conjunction with Mars. Their distance is less than the moon's diameter, but one will have to look sharp to see Mars at all in the strong twilight. He will be directly above the much brighter Mercury. On the 31st, Mercury and Venus come into conjunction. They are quite far apart, but the opportunity to compare the appearance of the two innermost planets of our system will be interesting.

Venus is also evening star in Aquarius, moving but slowly among the stars, and being steadily overtaken by the sun. On the 1st she remains in sight for over three hours and a half after sunset, but by the 31st this interval is reduced to a little over two hours. On the evening of the 9th she attains her greatest brilliancy, casting a distant shadow, and being easily visible in the daytime if one knows exactly where to look for her.

Since both Mercury and Venus reach a maximum of brilliancy during the month, it seems an appropriate time to discuss briefly the causes of their change of brightness. The brightness of a given planet, as seen from the earth, depends:

1st. On its distance from the sun. For the nearer it is to the sun, the more light it will receive, and so be able to reflect to us.

2d. On its distance from the earth. For the nearer it is to us, the larger, and consequently the brighter, it will appear.

3d. On the phase of the planet, as seen telescopically from the earth. For if the planet appears as a half-moon, it will send us but half the light that its whole disk would; and, in fact, less than half, since the visible part is lighted more obliquely, and in consequence less brightly, by the sun. This effect will evidently be much more marked when the planet appears as a crescent.

The orbit of Venus is so nearly circular that the effect of the changes in her distance from the sun may be neglected. The other two causes act in opposite directions. When Venus is farthest from us, behind the sun, her whole disk is illuminated, but her apparent diameter is so small that she is relatively faint. As she approaches us, the gain in brightness due to her greater nearness more than balances the loss due to phase, and this continues to be the case till after the time when she appears as a half-moon. But as her crescent narrows, the decrease of light becomes more rapid than the increase, and she begins to grow fainter. The point where the two effects balance, and the net gain in brightness changes to a net loss, is reached when the width of the crescent is a little more than half her radius, that is, when a little more than one-quarter of her apparent area is illuminated. This is the case on the 9th instant. After this, as Venus comes more nearly between us and the sun, the narrowing of her crescent rapidly cuts down her light. On January 31 the width of her crescent is but one-sixth of her radius, and though her diameter is nearly half as much again as on the 9th, she is but half as bright as she was then.

In the case of Mercury, the increase due to his approach to us and the decrease due to phase nearly balance one another all the way from superior conjunction (the full phase) to the greatest elongation (the half-moon). After this the phase gets the best of it, and his brightness decreases.

This simple relation is actually much modified by the results of his changing distance from the sun, since he receives more than twice as much light when nearest the sun as he does when most remote. In consequence, the maxima of Mercury's brightness usually occur near the times when he is nearest the sun, while the minima invariably happen when he is between us and the sun, and appears as a narrow crescent. The combination of the two effects also causes Mercury's brightness to vary quite irregularly, sometimes increasing or decreasing rapidly, and again remaining nearly constant for some time. The maximum of his brightness, which occurs about the end of this month, is due mainly to his nearness to the sun. His phase is a little more than the half.

Mars is an evening star, but is so near the sun that he is hard to see, though he may be picked up at his conjunction with Mercury on the 23d.

Jupiter is too near the sun to be seen. On the 15th he is in conjunction with him, and becomes a morning star.

Saturn is also in conjunction with the sun—on the 9th—and is invisible. Uranus is in Scorpio, rising at about 5 A. M., and Neptune is in Gemini, well observable in the evening.

THE MOON.

Last quarter occurs on the morning of the 1st, new moon on the afternoon of the 9th, first quarter on the night of the 16th, full moon on the afternoon of the 23d, and last quarter again on the morning of the 31st. The moon is nearest us on the 20th, and farthest away on the 4th. She passes Uranus on the morning of the 7th, Saturn, Jupiter and Mercury on the 9th (all being too near the sun to be seen), Mars on the morning of the 11th, Venus on the night of the 12th, and Neptune on the morning of the 21st.

Steamship Driven by Liquid Fuel.

The Shell Transport and Trading Company of London has one of its steamships plying between England and Borneo driven entirely by means of liquid fuel. This company has established a chain of stations between London, China, and Japan, via Marseilles, where their steamers can replenish their supply of liquid petroleum. The first station for this purpose in the English Channel has been recently opened at Dover, while the company contemplates founding similar stations at Havre and Liverpool. The company states, as the result of its experiments, that a vessel of 3,500 tons driven by liquid fuel requires only three firemen, whereas a crew of 18 or 20 firemen is necessary if coal is utilized. The whole of the furnaces throughout a watch are attended by one man, the feeding being automatic. The calorific power of the fuel is said to be from 60 to a 100 per cent higher than ordinary coal, while the space required for storage is about one-half. The fuel is residual from crude petroleum, is non-explosive, and is of the consistency of thin treacle. Another salient characteristic of liquid fuel is the cleanliness of the ship, since there is practically no smoke, and absolutely no grit or dust.

To Our Subscribers.

With the present issue, the SCIENTIFIC AMERICAN closes the fifty-sixth year of its existence. In this long period of time it has chronicled the scientific progress of the times and the important discoveries and inventions, and the history of the latter half of the nineteenth century can be better written from its pages than from any other source. Many subscriptions expire with the present issue, and our subscribers are urged, therefore, to renew their subscriptions promptly, in order that the paper may be received without interruption, as an expired subscription will not be continued after this issue. Those who are not subscribers to the SUPPLEMENT would do well to include this issue in their new subscription, and thus derive the benefit of the reduced combined rates. All those who desire to keep abreast of the times should subscribe to the SCIENTIFIC AMERICAN. With the January number the name of the SCIENTIFIC AMERICAN BUILDING EDITION will be changed to the SCIENTIFIC AMERICAN BUILDING MONTHLY.

A PENDULUM PROPELLER.

We have been favored by Mr. H. C. Vogt, M. Inst. Danish C. E., of Copenhagen, with photographs and an account of his new system of propelling and steering vessels, a system which is both new and ingenious. If an inventor should try to imitate artificially the movements of a man's leg, the impossibility of providing for the innumerable motions would soon be evident, but if any one of the motions of the leg be singled out, it is possible to obtain even better results by art than by nature. Mr. Vogt says that if from the animals capable only of moving on land, we turn our attention to aquatic animals or fishes, the examples for imitation become less complex, because in water, even the weight of the fish and the art of balancing is so simplified that the action of the tail or propeller is almost limited to propulsion and steering. In this case there is consequently something to imitate. The art of nature is concentrated in single lines of action which can be partly imitated. Anyone who has watched with what ease a dolphin passes an Atlantic liner, running at a speed of 22 knots, will readily see that the tail of some swimming animals must possess sufficient area to act on the water, and to avoid losing power. This area is bound to oscillate in accordance with the law of harmonic motion. When these propellers of nature oscillate, they communicate lateral as well as sternward velocity to the water, but a subsequent stroke always takes up a good deal of lateral energy given to the water by a previous stroke, whereas with real propellers this corresponding lateral energy is dispelled. From these and other deductions which Mr. Vogt has made both experimentally and mathematically, he has been able to construct an apparatus for propelling, steering, and maneuvering navigable vessels. The device is one by which propelling, steering and maneuvering are all effected by means of a rudder whose head is formed as a shaft and mounted in a tube fixed perpendicularly, or approximately so, to an oscillatory driving shaft. It is connected at its upper end through a spring or springs to a steering and maneuvering device, so that the oscillation of the driving shaft and the consequent pressure of the water on the oscillating rudder causes it to execute movements similar to those of the tail of a fish, and compounded of oscillations about the axis of the driving shaft and oscillations about the common axis of the tube and the rudder-head, while the mean position of the oscillating rudder in relation to the tube can, by means of the steering and maneuvering device, be fixed or varied, as required in order to fix or change the direction of motion of the vessel. The apparatus is adapted for use in a steam vessel of ordinary construction and to be mounted therein with the rudder in a position under the stern similar to that ordinarily occupied by a screw propeller. The upper end of the rudder-head, formed as a shaft, is connected by a universal joint having its center in the axis of the driving shaft, with a steering and maneuvering shaft whose upper end is connected to springs tending to prevent the rotation of the steering and maneuvering shaft about its own axis in both directions, so as to be put under stress by the pressure of the water on the rudder-blade when it is oscillated and thereby to limit such oscillation. The rudder-blade is preferably laminated so as to impart to it elasticity, which has been found to increase its efficiency.

The rudder-head, instead of extending upward beyond the oscillating driving shaft and having a spring or springs secured to its upper oscillating end, terminates at the driving shaft and is connected with a vertical shaft having a stationary axis, by means of a universal joint, whose center is in the axis of the driving shaft. The upper end of the shaft has fixed to it a disk or wheel, *A* (see diagram), which is connected by radial helical steel springs, *C*, with a ring, *B*, which is mounted on and kept down to a support by means of catches. The ring, *B*, can be turned by means of a worm, *D*, driven by bevel wheels, *E*. The connection between the wheel and the ring enables the position of the vertical shaft to be altered as required by turning the ring by means of the worm, the turning power being transmitted by the springs. The oscillation of the tube with the rudder-blade is similar to that of a pendulum, its speed varying gradually from zero when most to one side of the vessel, through a maximum when vertical, to zero when most to the other side of the vessel, and vice versa, so that when the vessel is moving straight ahead, the position of the blade may, under the combined action of the springs and the water, vary gradually from being directly fore and aft when farthest a-port and farthest a-starboard to being most inclined to a directly fore and aft position (in one direction or the other, according to the direction of motion of the tube) when the tube is vertical, so that the springs are then at their greatest tension and have accumulated a certain amount of energy, which returns the blade to its directly fore-and-aft position during the remainder of its semi-oscillation about the axis of the shaft. Experiments indicate that the rudder-blade should not make an angle greater than 45 degrees with a directly fore-and-aft position when the tube is vertical. The amplitude of oscillation of the tube may be 80 degrees. By turning the shaft, by means of the ring, *A*, through angles up to 90 degrees, in one or the other direction, the vessel can be turned to port or to starboard, as desired, since the rudder-blade will be more perpendicular to its direction of motion, and will consequently act more forcibly on the water when moving in one-half oscillation than in the next, while by turning the shaft through 180 degrees the motion of the vessel can be reversed. The desired oscillation can be imparted to the shaft by any suitable means, for example, an arm projecting therefrom may be jointed to the piston rod of an oscillatory steam cylinder. Instead of steel springs such as described, pneumatic cylinders or cushions may be employed.

PENDULUM PROPELLER DRIVING FORWARD, SHOWING SHAFT.

PROPELLER DRIVING ASTERN.

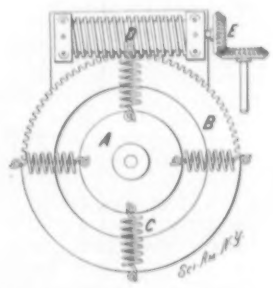


DIAGRAM OF TOP OF STEERING HEAD.

VOGT'S PENDULUM PROPELLER, SHOWING BALL-AND-SOCKET JOINT AND STEERING MECHANISM.

Mr. Vogt has made important experiments, beginning in the autumn of 1900, with a screw boat 20 feet long, 5 feet broad, draft of 2 feet and a displacement of about 1½ tons. The petroleum engine had an indicated effective horse power of 1.7 at 300 revolutions. Power is transmitted to the old propeller shaft by means of bevel gears, so that the revolutions of the engine are reduced from 300 to 120. By means of a crank and connecting rod these revolutions are transmitted to the rocking shaft of the pendulum propeller, making 120 double swings, corresponding to the 300 revolutions of the motor. The experiments showed high efficiency and it was found that the driving thrust of the pendulum propeller was greater than the screw propeller, and that the maneuvering ability was greater than attainable by twin screws and helm together, on account of the greater length between the propeller and the center of turning of the ship. The Russians have decided to see if the pendulum propeller is better for the purpose of ramming than the screw-propeller, and their government has ordered a launch furnished with a pendulum propeller, but it is not believed that the conditions are favorable, because the engine power is great in proportion to the size of the boat. The illustrations which we have reproduced, showing the propeller in various positions, were especially made for the Scientific American by lifting the boat with a crane, and it is only fair to state that the boat is an old one, originally fitted with a propeller. Mr. Vogt has bought the hull of an old Danish gunboat of 100 tons displacement. A pendulum propeller 7 feet long making two double swings per second, corresponding with two revolutions of the engine per second, will be provided. This will give the vessel a speed of 7.3 knots and require 40 effective horse power. This would give the ship the same speed as 50 or 53 horse power with screw propellers, but a 50 horse power screw engine might weigh less. Mr. Vogt considers that a steam turbine in connection with proper gear might solve the difficulty of weights, and until this difficulty with the engine is solved, the pendulum propeller will be limited to sailing ships. Mr. Vogt thinks if some clever American could solve the problem of the engine, the propeller itself would be very much superior to the screw propeller in every respect.

Irrigation Society's Protest.—The Executive Committee of the southern California section of the National Irrigation Association has formulated a telegram of protest which has been sent to President Roosevelt. The telegram calls the President's attention to a report sent out from Washington that he would recommend to Congress action for the reclamation of the arid lands which will have the effect of intrusting to the States, instead of the agents of the Federal Government, the systematic development of the plans for irrigation works. The committee represents that such a policy would be a serious error and a death blow to the National irrigation movement, and to an era of home building on the public domain.

The telegram also calls the President's attention to his letter of November 16, 1900, to the National Irrigation Congress at Chicago, which it is said "crystallized the sentiment dominating that convention, that the reclamation of the arid lands must be kept absolutely within the control of the national government."

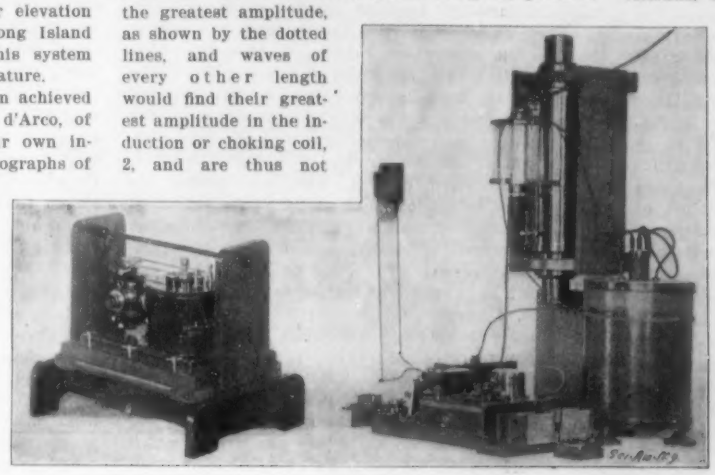
Electric pickling of iron, according to a recent patent, is accomplished by using an electrolyte consisting of acid and alkaline, or alkaline-earthy salts. An example of such an electrolyte consists of 1,000 pounds of common water, 100 pounds of hydrochloric acid, 5 pounds of sulphuric, 5 pounds of hydrofluoric, and 15 pounds of caustic soda or potash. A bath lined with lead is used, and the iron or steel to be cleaned forms the cathode, the anode consisting of platinum, lead or carbon.

THE SLABY-ARCO PORTABLE FIELD EQUIPMENT FOR WIRELESS TELEGRAPHY.

BY A. FREDERICK COLLINS.

The trend of thought in wireless telegraphy, just at present, seems to be in the direction of utilizing balloons and kites instead of the high masts or antennæ heretofore employed. Tesla expects to use small hydrogen bags to obtain the proper elevation in the forthcoming experiments at his Long Island station, and Marconi intends equipping his system at Cape Race with balloons of the same nature.

Striking results are reported to have been achieved by Dr. Slaby and his collaborator, Count d'Arco, of Germany, with a portable system of their own invention, the description, drawings and photographs of which I have been fortunate enough to obtain through the kindness of Dr. Slaby and the General Electric Company, of Berlin. The system these physicists have developed has received a tremendous impetus by the success of the inventors on occasion of an audience recently granted them by the German Emperor, when they received simultaneously two messages sent from different points. In this particular instance one of the transmitters was located at a distance of seven miles and the other two and one-half from the dual receiver where the exhibition took place. And this wonderful accomplishment has been the result of only five years of labor, for it was on the 11th of May, 1897, when the crucial tests of Mr. Marconi's then new wireless system were being made in England, that the Italian inventor was assisted by Prof. Slaby, who saw and believed in the ultimate useful future of spark telegraphy. To-day both he and Marconi are the inventors of improvements of the highest type, and these improvements are for the greater part specifically for the purpose of enabling messages to be sent and received by a number of operators in the same vicinity at one and the same time. Prof. Slaby terms this method of selectiveness multiple wireless telegraphy, and Mr. Marconi designates his means to this end under the caption of syntonic wireless telegraphy.



Mercury Interrupter. Slaby Receiver for Ships.

PORTABLE APPARATUS FOR WIRELESS TELEGRAPHY.

The apparatus of Slaby-Arco, while in the direct line of preceding systems wherein the spark of disruptive discharge of an induction coil radiates the waves, varies materially in detail from all others by virtue of the absolutely novel theory these workers have evolved and advanced concerning the action of the "wireless" or electric waves.

In the SCIENTIFIC AMERICAN under date of March 9, 1901, there was published a very complete report of Prof. Slaby and Count d'Arco's work along these lines, and unfolded the results of their progress up to that time, namely, the resultant action on and relations of the electric waves and the antennæ or vertical receiving and transmitting wires, and giving as the mechanical analogue of the stationary waves thus set up a vibrating steel wire. Since these phenomena have already been described, I will simply refer the reader to the paper mentioned for the fundamental principles involved, and take up the thread of the improvements made by the inventors since that time.

It will be necessary to refer to their older methods occasionally, in order to elucidate the value of the new, since many of the former difficulties have now been removed, as the following text, drawings, and photographs furnished by the Allgemeine Elektricitäts-Gesellschaft (General Electric Company) of Berlin will show.

In the older description referred to, Slaby made use of a transmitter (Fig. 1), the antenna or vertical wire of which was connected to an induction coil, 2. All waves of a predetermined length would emanate from the end of the wire, 7, this being the point of the greatest amplitude, as shown by the dotted lines, and waves of every other length would find their greatest amplitude in the induction or choking coil, 2, and are thus not permitted to radiate into free space, but find their way down to the earth by the wire, 4. It will be observed that the antenna, 1, the coil, 2, the returning wire, 4, and the earth, 5, complete a circuit. Dr. Lodge, of England, has shown that while such an arrangement forms a very persistent oscillator of the waves, as an emitter it is very poor indeed. But this is not its only drawback. One of the great advantages of the Slaby receiver was the fact that any vertical wire, even though it was in the form of a lightning rod, could be employed to receive the waves; but the real value of this was lost, as the coil and parallel wire in transmitting were necessary, besides the obvious objection involved in elevating the coil.

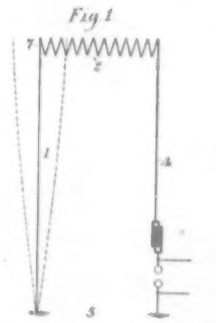
In the new form of the appliance the inventors use as a transmitting antenna the one by which the messages are received; and another feature which is of the utmost importance, assuming that the deductions upon which the whole scheme is based are substantially correct, is that the rod may be used intact. Such an arrangement is shown in Fig. 2. *A* is the transmitting station and *B* the receiving station. The coil, 1, at *A* is an adjustable inductance, and by varying its length through the point, 2, the length of the antenna, electrically, may be given a suitable value which corresponds to the wave length of that produced by the induction coil. Now it will be seen that a lightning rod of any height may be made to conform electrically with the requirements of the wave-producing apparatus without mechanically altering its height.

The inductance coil, 3, and the capacity, 4, are also adjustable, and by varying their values a wave length emitted by the coil, 5, may be so modified or changed as to correspond exactly with the wave length represented by the vertical wire, 6.

If the receiving antenna, *B*-1, is adjusted to the wave length of the transmitting antenna, *A*-6, the periods of oscillation in each are equal and a tuned system is the result. In this apparatus a Ruhmkorff coil, 5, is used with a centrifugal mercury interrupter, by which a steeper wave front of the disruptive discharge is secured. The receiving device usually consists of a Morse printing register, for on the Continent it is preferred to the ordinary sounder, probably for three reasons: (1) it is more easily adjusted; (2) it is often desirable to have a record; and (3) wireless messages are more easily read by sight than by sound, for the number of transmitted words per minute is rarely more than 12.

The relay, coherer, tapper and sounder are connected to the terminals, 5 and 5'. Here again the adjustable inductance coils, 2 and 7, serve to obtain a tuned or syntonized system corresponding to that of the transmitting station, 1. The coherer, 4, and the method of connecting it to the accessory apparatus is shown in the figure.

In one of the half-tones is shown a complete sending and receiving apparatus for a single station of the portable type. It consists of a portable storage battery (to the left) connected with an inclosed Ruhmkorff coil with key also inclosed and attached, the knob allowed to project in the photograph, three variable inductance coils, one box kite, one bird kite, coherer, receiver telephones and windlass. Fig. 3 represents diagrammatically the apparatus. In this form no great effort is made to tune the system, although the inductance coils are for this purpose, but it is intended for field and military work and for places where there is little possibility of another system or other interference. One of the greatest obstacles to the successful transmission of wireless messages during the early part of the British-Boer war was the heavy accouterments accompanying the instruments sent there by the Marconi Wireless Company of London. Masts of 100 or even 80 feet in height are much too cumbersome to be transported with the facility necessary in such all-important



Early Diagram of Transmitter.

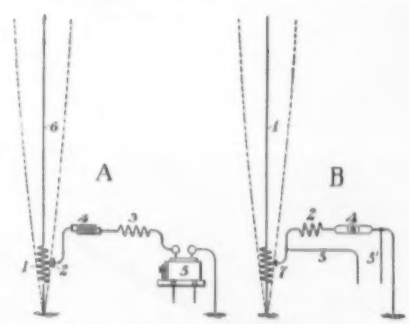


Fig. 2.—Transmitter and Receiver.

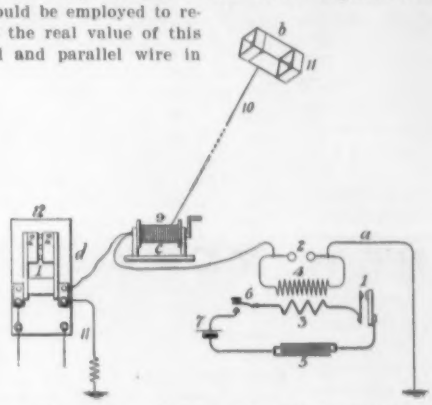


Fig. 3.—Reproduction of Dr. Slaby's Sketch.

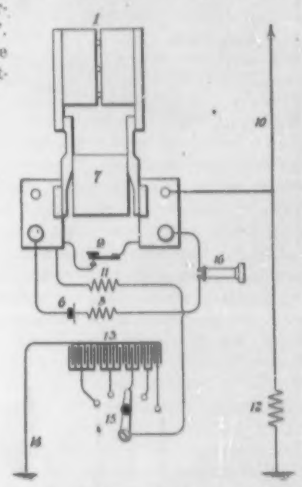


Fig. 4.—Slaby's Microphone Receiver.

1. Storage Battery. 2. Induction Coil. 3. Inductance Coils. 4. Microphone Receiver.

A NEW SYSTEM OF PORTABLE WIRELESS TELEGRAPHY.

operations; and as the instruments themselves were useless without an antenna of this height, the whole scheme was abandoned and prehistoric signals of the Neolithic age were substituted in their stead. The portable Slaby-Arco system is arranged to overcome the difficulties that actual experience earned so dearly has pointed out.

The portable induction coil (Figs. 3 and 4) is equipped with a vibrating interrupter of the usual type, 1, and the spark-gap, 2, is likewise of the ordinary character, being open in contradistinction to those inclosed in oil. The primary winding is shown in Fig. 4; 3 is the primary and 4 represents the secondary winding and terminals; 2, the spark-gap; 1, the interrupter; 5, the condenser of the coil; 6, the Morse key; and 7, the storage battery. One terminal of the secondary coil leads to the earth at *a*, and from the second terminal a conductor leads to the windlass, 9, where it is connected to the flexible metallic cord, 10, it in turn being attached to the box-kite, 11. The apparatus, 12, consists of what Prof. Slaby terms a microphone receiver. By this designation he distinguishes between two classes of receivers, namely, (*a*) those which require tapping to decohere the particles of metal and (*b*) those which are termed in this country self-restoring or self-righting; that is to say, that in the case of *a* the low resistance produced by the action of the electric waves will so remain until the normally high resistance is restored by some physical means, and in *b* where the restoring properties are self-contained, and the normally high resistance is instantly assumed the moment of cessation of the waves. Carbon possesses this property, likewise steel and iron, and so it is that the imperfect electrical contact discovered by Hughes in 1882, and which furnishes us with the modern telephone transmitter, now plays an exceedingly interesting part in wireless telegraphy in the form of the coherer, first made by Branly, of Paris, in 1890. Later Popoff used a microphone-coherer or a self-restoring coherer in which he mixed steel filings with carbon granules. The self-righting coherer for army and field telegraphy has a distinct advantage over those which require tapping, inasmuch as it does away with a vast amount of complicated and more or less delicate apparatus; again, the words can be received as rapidly as the operator can send. The improvement claimed by Slaby is that in his coherer of the microphone type a combination of steel and aluminium is used, either in the form of grains or of balls such as are used in telephone transmitters. In Figs. 3 and 4, 1 represents the steel aluminium coherer; 2 shows the cross section of the aluminium disks, and between them are placed the hardened steel balls. Atmospheric disturbances and electric waves emitted from lightning are avoided by placing the coherer in shunt to the wave system, 10 and 11 (Fig. 4), and not directly in series with it. The complete receiver is shown in Fig. 4.

The electromotive force actuating the telephone receiver consists of one dry cell, 6, only (Fig. 4) and this is connected in series with the double-pole switch, 7, and the choking coil, 8. By means of the key, 9, the current may be made or broken, the operator closing the circuit when listening to a message transmitted from another and distant station and releasing the key opening the circuit before transmitting a message. This is done to prevent the powerful radiations so closely to hand from welding the particles together and rendering the coherer worthless as a receiver for very feeble waves. When the electric waves from a distant transmitter are sent out the conductor cord, 10 (Figs. 3 and 4), receives the impulses and carries them to the microphone coherer, 1, when the high resistance is instantly lowered and now permits the passage of the weak battery current to flow through the coherer and also the telephone receiver, 16, for the period the waves are received, and the characteristic sounds of cohesion are heard through the variation of the electric current. Dots and dashes are distinguished by the length of time the cohesion exists or the variation of the current. In the half-tone the telephone receiver takes the form of a pair of watch-case or pony receivers connected by a flexible metal spring such as telephone operators wear during working hours.

The tuning of this receiver is accomplished by means of the inductance coil, 12 (Fig. 4), which is in tune with the receiving wire, 10. This coil is in shunt and is in tune with the emitted waves of the opposite station transmitter by the self-inductance, 11, and by the condenser, 13, grounded at 14, the capacity of which may be varied until the most suitable value is obtained by the handle, 15. The sensitiveness of a microphone coherer is much greater than that of a permanent coherer with the exception of the most carefully adjusted silver coherer, and for this reason it lends itself to the purpose of long-distance transmission; but since the maximum resistivity and minimum conductivity of a microphone coherer are not widely divergent, the current from the battery, 6, is insufficient to operate a relay, and therefore will not answer where a printed copy is desired.

The transmitter and the receiving apparatus utilize the same flexible cord as the receiving or emitting wire, and this angular antenna leads to the kite. Slaby employs various forms of kites for elevating the antenna; the American Blue Hill box-kite having a large sustaining surface is used in case of light winds; for stronger winds the box-kite is equipped with a much smaller surface. With winds so light that these kites cannot be used a special form of German kite having the shape of a bird is recommended. If there is no wind at all, small hydrogen balloons are provided having a capacity of one cubic meter. The weight of one station complete, including transmitters, batteries, receivers, auxiliary apparatus, etc., is 30 kilogrammes, and the greatest distance intelligible signals can be transmitted is 20 kilometers.

Through the generosity of Mrs. Joseph M. White, of New York city, the Scientific American for the year 1902 will be sent to the fire engine and hook and ladder companies of New York city. Mrs. White has been in the habit of donating the paper for a number of years in this manner, her object being as far as possible to provide reading matter of an educational and suggestive character for the men who are so often called upon to risk their own lives to save those of others.

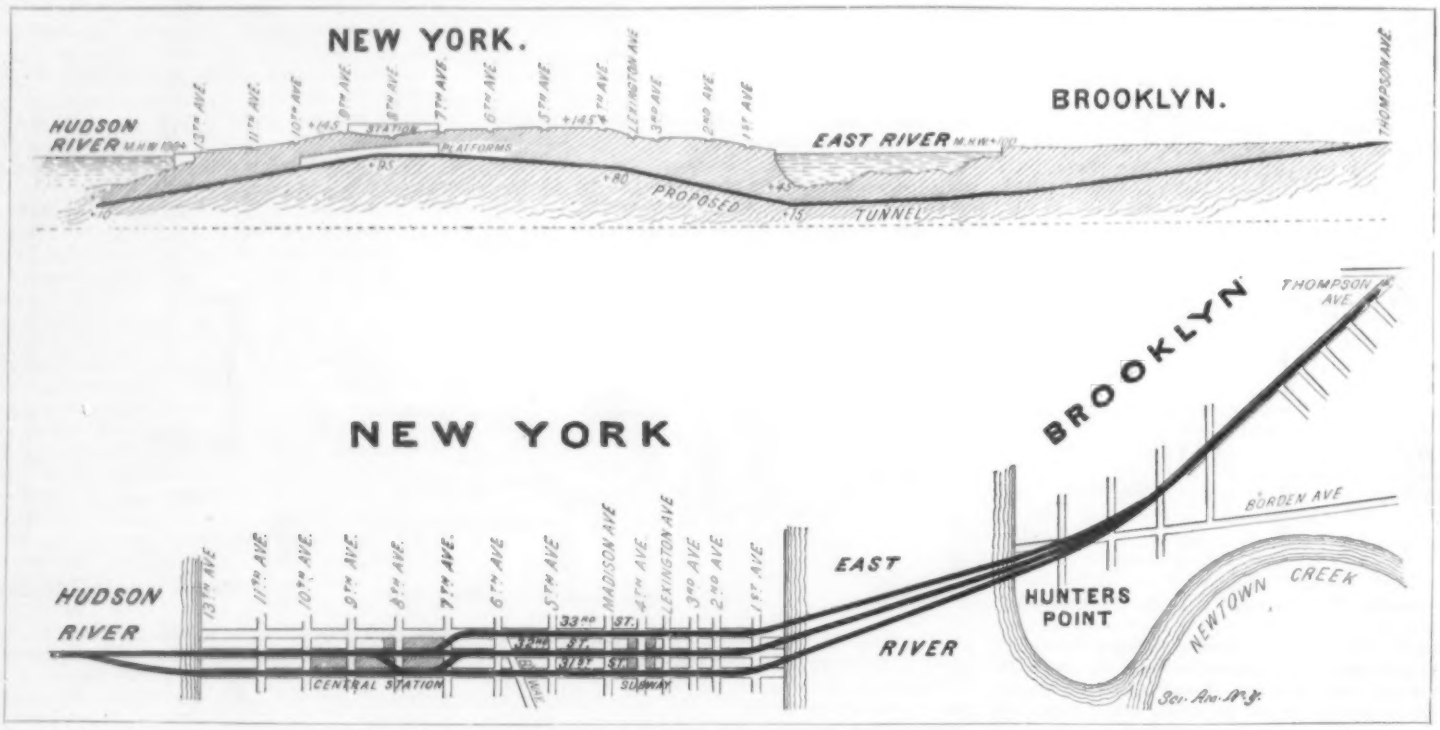
THE PENNSYLVANIA-LONG ISLAND CONNECTING RAILROAD TUNNELS.

The very topographical location which has rendered New York city one of the greatest seaports in the world has brought with it no end of trouble to the citizens who live within its borders. While the confluence of the Hudson River with the East River and the long stretch of shore line which extends between the exits of the Harlem River have provided the most magnificent line of wharfage in the world, it has brought about in the course of years one of the most difficult and complicated transportation problems on earth, a problem which is demanding a solution with increasing emphasis as the years go by. With the exception of the New York Central Railroad with its one terminal station (which, by the way, is already quite inadequate to the demands upon it) at the center of Manhattan Island, there is none of the great trunk lines of the United States that has its terminal within the metropolis. To anyone who is conversant with the history of passenger transportation, it must have been evident for many years past that it was only a question of time when not merely the great railroads, but the local trolley lines and the suburban roads, would be called upon to make connection of some kind with Manhattan Island, and land their passengers directly in the heart of the city itself.

The obstacle, of course, has been the great cost and supposed difficulty of making this connection. As far as the East River is concerned, it necessitates bridges of at least 1,500 feet clear span or tunnels of great length, considerable depth and presumably somewhat heavy gradients. The East River is already spanned by one completed and one half-completed bridge; but neither of these is designed or adapted to trunk line railroad service. Several years ago the Long Island Railroad commenced the construction of a bridge at Blackwell's Island, but the work never progressed beyond the foundations. Also, some twenty years ago an abortive attempt was made to drive a tunnel from Jersey City to Manhattan beneath the Hudson River, but although some 3,000 feet was completed, the work was ultimately abandoned.

The alternative problem of bridging the North River was rendered such a stupendous one by the requirements of the War Office that no pier should be placed between the government pierhead lines, thus necessitating a span of at least 3,000 feet, that no actual work has been done on such a structure. It is now about ten years since Gustave Lindenthal, who is to be the new Commissioner of Bridges, formulated plans for a great suspension bridge of 3,000 feet clear span, which was designed to carry eight railroad tracks on the lower deck, and, if traffic should demand it, four more tracks on an upper deck. The great cost of this structure, coupled with the even greater cost of the necessary terminal works, has stood in the way of its prosecution. Another suspension bridge was designed to cross the North River at 59th Street, but this also has never progressed beyond the paper stage.

After the acquisition of the Long Island Railroad by the Pennsylvania Railroad there was a revival of the rumors that the trunk lines, which have their termini in Jersey City, were contemplating joint action in the construction of a bridge. This time the



PLAN AND PROFILE OF THE PROPOSED PENNSYLVANIA-LONG ISLAND CENTRAL STATION AND CONNECTING TUNNELS.

Pennsylvania Railroad was mentioned as the chief mover in the project; but it seems that the failure of the other roads to come to an agreement as to the proper distribution of the expense of construction has led this corporation to abandon the idea of a bridge, and turn its attention to the connection of the Pennsylvania and Long Island Railroads with each other and with New York by a system of underground tunnels.

The accompanying plan and profile of the proposed tunnels is drawn from plans filed in the County Clerk's office by the Pennsylvania-New York Extension Railway Company, which has been authorized to build and operate the tunnels. The line of the tunnel, as shown in the plans, commences at the State line in the center of the Hudson River. As it approaches the Manhattan shore the two tunnels, each of which will be 18 feet in diameter, diverge until they are opposite the centers of 31st and 32d Streets. They extend with an easy rising grade of less than 1.5 per cent to about the middle of the block between Eighth and Ninth Avenues, where the line is level for about 1,500 feet, the surface of the tracks being about 45 feet below the surface of the street. From just beyond Seventh Avenue, the line falls again on an easy grade to a point between Fourth and Lexington Avenues, where the track will be about 60 feet below the surface. From this point to the East River the grade increases to about 1.5 per cent, the lowest level being near the New York side, 85 feet below mean high water and about 30 feet below the deepest level of the river bottom. From this point the ascent is by an easy grade of from about 0.5 per cent to 1.2 per cent, until the tracks come to the surface at Thompson Avenue, about 1½ miles from the East River.

The great central station with its underground "yard" (if that term may be used in this case) will cover more than four large city blocks. It will include all the space between Tenth and Eighth Avenues and 31st and 33d Streets, and between Eighth and Seventh Avenues and 31st and 33d Streets. It will also include a portion of the easterly end of the block bounded by Eighth and Ninth Avenues and 32d and 33d Streets. Easterly from the central station, a third track and tunnel will be added, the three tracks extending below 31st, 32d and 33d Streets, until First Avenue is reached, where they will swing to the north through 30 degrees, and will converge, meeting near the Long Island terminals. From this point the tracks will be carried in a single tunnel, finally reaching the surface at Thompson Avenue.

The construction of the tunnels is not expected to present any unusual difficulties where they extend below Manhattan Island and the East River, the driving having to be done largely through rock or firm material. Beneath the Hudson River, however, where the tunnels, according to the plans filed with the County Clerk, will descend to a depth of 90 feet below mean high water, the line will have to be carried through a soft material, which does not present the proper consistency for preserving the tunnel in true vertical and lateral alignment, especially under the heavy traffic which the tunnels are expected to carry. Of course, firmer material could be secured by tunneling at a lower depth, but this would entail the great disadvantage of steeper grades, with their attendant disadvantages in operating the road. To meet this difficulty, Mr. Charles M. Jacobs, the chief engineer of the company, has designed a special system of construction, in which the tunnel consists of a combined tube and bridge, having great transverse vertical strength, while the load of the combined structure is borne by piers, which are carried down by the caisson system through the underlying silt until firm hardpan or rock bottom is reached. By using this system of construction it is possible to build the tunnels through looser material at a higher elevation, and the grades to Jersey City and New York are kept down to the desired maximum for economical operation.

The great central station will contain twenty-five tracks, access to which will be gained by a broad causeway which will be reached from the street surface by easy grades at either end of it. This causeway will extend across and above the tracks, and easy stairways will lead from the causeway to the platforms.

In the operation of this system electric traction will, of course, be employed for all trains, and incidentally it may be stated that the confidence with which the Pennsylvania Railroad system is contemplating the use of electric motors for bringing trains into its terminal station, should act as a spur to the New York Central and New Haven systems in adopting the same method between Mott Haven and the Grand Central Station. If such power is feasible for one system, it is certainly so for the other. The ventilation of the tunnels will be secured by the passage of the trains, which will act with piston-like effect, keeping the body of the air in continual circulation. Regarding the advantages conferred on New York by the enterprise of the Pennsylvania and Long Island Railroads, it is scarcely possible to say too much. Not only will passengers be brought from any part of the United States without change of cars direct into New York, but the fact that the new tunnels will cross beneath all the north and south lines of the tunnel in Manhattan, including the new Rapid Transit tunnel, insures that travelers will be provided with most excellent facilities for getting quickly from the trunk lines to the immediate street or section of the city which is their destination.

At a later date we hope to publish full plans both of the terminal and tunnel construction.

NEW SUBMARINES FOR THE UNITED STATES NAVY.

The acceptance by the United States navy of the submarine torpedo boat "Holland," and the determination of the government to build half a dozen new boats of the same type of somewhat enlarged dimensions, marked the successful culmination of a long series of trials and disappointments which had attended the efforts of the inventor, Mr. Holland, to produce a successful submarine vessel. The "Holland," which was the first really successful boat constructed on the inventor's principles, is the sixth experimental craft which he has built. His first attempt was made in 1871 with a small vessel 3 feet by 2½ feet in cross section and 14½ feet in length. This was followed by a larger craft, built in 1897, which was 31 feet in length by 6 feet in diameter. It was driven by a 15-horse power engine and carried a crew of two men. In this vessel we see the first attempt to discharge high explosives, the Zalinski gun being fitted for the purpose of throwing dynamite shells. Then followed another craft 16½ feet long which met with various mishaps. The fourth boat, 40 feet in length and about 8 feet in diameter, was destined to bring Mr. Holland's invention more prominently into notice than any of his previous craft; and it was used in experimental tests which gave valuable data for future work.

On March 3, 1893, Congress authorized the construction of a submarine of the Holland type, and the contract for the hull and machinery was let for $150,000. Although the contract for the "Plunger," as she is called, was signed in 1895, the vessel is still uncompleted. She is in some respects a considerable departure from the Holland type, being very much larger (85 feet over all) and having a submerged displacement of 165 tons. For surface navigation she was to be provided with a triple-screw engine, and when submerged the vessel was to be driven by a single electric motor. Subsequent changes, however, have been made in these plans, and we understand that when the vessel is finally completed, she will conform generally to the standard Holland type.

The sixth Holland submarine, which was built at the Crescent Shipyard, Elizabethport, N. J., is 53 feet 11 inches in length, 10 feet in diameter and has a displacement of 74 tons when submerged. When on the surface she is driven by a single-screw, Otto gasoline engine of 45 horse power, at a speed of 8 knots an hour. When submerged, she is driven by an electric motor of 50 horse power. Her armament consists of a torpedo tube which lies approximately on the longitudinal axis of the vessel and a dynamite gun which is upwardly inclined and is intended for the discharge of high-explosive shells when the vessel is at the surface. The "Holland" was first placed in commission October 12, 1900. So far, she has been used mainly for training purposes, and in experimental tests by the Holland Company. Useful data has been gathered from her which will be incorporated in future vessels. On June 7, 1900, Congress authorized the construction of six more submarines of the Holland type. Of these two, to be known as the "Grampus" and the "Pike," are being constructed by the Union Iron Works, San Francisco, Cal., and the other four, known as the "Adder," "Moccasin," "Porpoise" and "Shark," are building at the Crescent Shipyard.

On the front page of this issue will be found a sectional view, showing the new type of Holland boats, as they will appear when submerged. The side being broken away, it is possible to see very clearly the method of constructing the boat and the arrangement of the various parts of her machinery and fighting equipment. The dimensions are as follows: Length over all, 63 feet 4 inches; diameter, 11 feet 9 inches; displacement, submerged, 120 tons. The motive power consists of a 160-horse power single-screw, four-cylinder, Otto gasoline engine, which is capable of giving the craft a speed of 8 knots on the surface, and a 70-horse power electric motor, which gives the vessel a speed of 7 knots when awash or submerged. The hull is circular in cross section and is divided by two watertight bulkheads into three separate compartments. There is also a thorough subdivision of the bottom, and every precaution is taken to localize any injury to the hull which might threaten the buoyancy. In the forward compartment is a torpedo tube for the discharge of 45-centimeter Whitehead torpedoes. The tube is placed with its muzzle in the nose of the craft and its axis inclined somewhat to the longitudinal axis of the vessel. The muzzle of the torpedo tube is closed by a watertight door, which can be lifted from within for the discharge of torpedoes. In the same forward compartment are a series of air flasks, a gasoline tank of 850 gallons capacity, a compensation tank which will be filled with a sufficient amount of water to compensate for the loss of weight due to the discharge of the torpedo, and one of the trimming tanks.

The central compartment contains in its double bottom the main ballast tanks and a circular compensating tank which will be noticed in our engraving between the two sets of batteries. Above the double bottom and below the axis of the vessel are located the storage batteries. These are charged by the gasoline engine running the electric motor as a dynamo when the vessel is at the surface. Above the storage batteries are carried the torpedoes, which are 45 centimeters in diameter by 11 feet 8 inches in length; and in the same compartment are a series of air flasks, in which air at 2,000 pounds to the square inch pressure is stored for the purpose of keeping pure the living spaces of the crew. In the rear compartment is the four-cylinder gasoline engine, which is rated at from 160 to 190 actual horse power, at from 320 to 390 revolutions per minute. Its net weight is 1,300 pounds. Its length over all is 9 feet 7 inches, and its total height above the crank-shaft center is 5 feet 6 inches. In these engines, which have given great satisfaction in the first Holland boat, the distribution of the cranks and the timing of the valves and igniters are so arranged that the operations in the four cylinders alternate; so that while one is on the expansion stroke the other three are on the suction, compression and exhaust strokes respectively. By this arrangement the engine is perfectly balanced and vibration is reduced to a minimum. The fuel consumption of the first engine proved from measurement to be 0.88 of a pound of gasoline, of 0.74 specific gravity (Baumé scale).

In the construction of the vessels care has been taken that all portions of the exterior of the hull shall be free from projection of a kind that might be entangled by ropes or other obstacles when submerged. The lines of the vessels have been designed so that there shall be a minimum of resistance when they are running at the surface. The radius of action at the surface is about 400 knots, and the storage batteries have sufficient capacity for a speed of 7 knots on a four hours' submerged run. Gearing is provided for driving the propeller direct from the gasoline engine or connecting the engine to the main motor, accommodations being effected by means of suitable clutches. The submersion of the vessel is achieved by means of ballast tanks and a pair of horizontal driving rudders at the stern. For keeping her submerged at desired depths, use is made of the trimming and ballast tanks above described, and it is claimed that the control in this respect is very satisfactory. The air supply and ventilation are secured by means of compressed air stored in the tanks referred to, while the gasoline vapors from the engines and, indeed, all noxious gases are carefully excluded by suitable devices, while safety valves are provided to prevent the pressure in the vessel from exceeding that of the atmosphere. Provision is also made for automatic control of the rudders; for the purpose of preventing the vessel from taking excessive angles when diving, or coming to the surface, and also for keeping the boat submerged at the desired depth.

In spite of the difficulties attending the whole problem of submarine navigation, it is generally admitted that the Holland boat has come as near to mastering them as any craft of the type that has been built. Just what the French have done we do not know with any degree of accuracy, but they appear to have made some successful long-distance trips without detection, although this is nothing more than the Holland type is claimed to be capable of doing. We understand that a trip of several hundred miles down the Atlantic coast is shortly to be undertaken. Although its fighting powers can only be determined in actual war, it is agreed among naval experts that the submarine will have a decided value as forming part of a system of harbor defense. Certain it is that a fleet of them would have the effect of causing a blockading fleet to retire at night-time much further from the mouth of a harbor than it would were no such machine as the submarine known to exist.

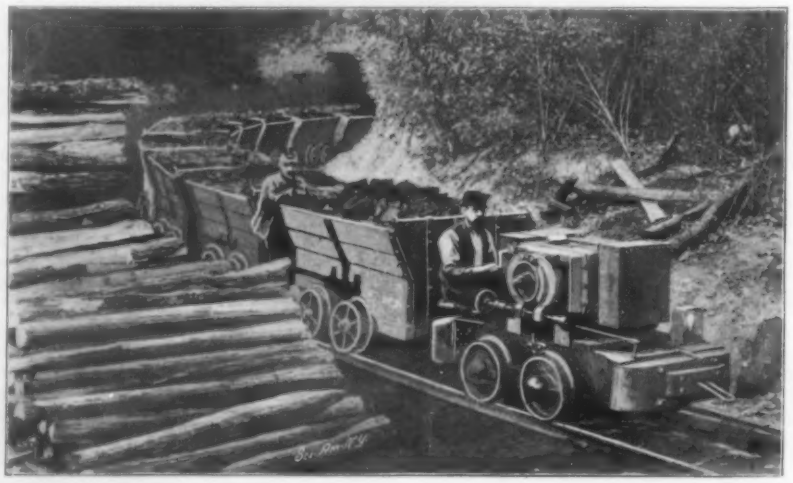
The Current Supplement.

The current SUPPLEMENT, No. 1356, has a number of articles of unusual interest. "Discoveries in Mesopotamia," by Dr. Friedrich Delitzsch, is accompanied by most attractive engravings. "Missing Links" is a lecture delivered by Prof. Thomas H. Montgomery and is especially reported for the SCIENTIFIC AMERICAN SUPPLEMENT. "Recent Experiments with Sound Signals" is by J. M. Bacon. It is a most valuable paper. "Nicaragua or Panama" is by a former Chief-Engineer of the Panama Canal, Mr. Philippe Bunau-Varilla.

THE COMBINED THIRD AND TRACTION RAIL SYSTEM OF HAULAGE.

The accompanying illustration shows a plant of the Morgan system in operation at the works of the Donohoe Coke Company, of Greensburg, Pa. Many plants of this system are now in successful operation in various parts of the United States, demonstrating its adaptability to the various conditions of mine haulage. At the Donohoe works referred to, the locomotive is hauling out of a drift opening, and a considerable portion of the track is outside of the mine. It is getting out a large output on a 4 per cent grade against the loads. At the Sarah mine of the Pittsburg Coal Company, at Douglass Station, Pa., the locomotive is hauling the loads up a 10 per cent grade. The third rail carries 550 volts pressure; 200 feet of this third rail is outside of the mine and no delay was experienced from the heavy snow and sleet storms of last winter and spring.

At the Murphysboro mine of the Big Muddy Coal & Iron Company, of St. Louis, the locomotives are hauling heavy trips of cars on grades both against and in favor of the loads, thus demonstrating the capability of the locomotive to safely bring loads down heavy grades as well as its power to haul up such grades. The capability of the system to work successfully on very sharp curves and on light rails is well illustrated at the Minglewood mine of the Massillon Coal Mining Company of Massillon, Ohio, there being many sharp curves in the 7,000 feet of motor road and the rails weighing but 16 pounds per yard.



COMBINED THIRD AND TRACTION RAIL SYSTEM OF HAULAGE.

In this system the electric current to supply the motor and the traction to drive the locomotive along the track are furnished by a single third rail. The third rail consists of heavy iron bars, perforated at regular intervals throughout their entire length, and made into a continuous rail by means of fish-plates much after the manner of regular track rails. This continuous rail is inclosed in a specially prepared wood casing, which serves the double purpose of insulating the rail and protecting men and animals from the current. This complete third rail is laid 5 inches off the center of the regular track, thus giving room for the animals to work, so there need be no interruption to the working of the mine while the plant is being installed.

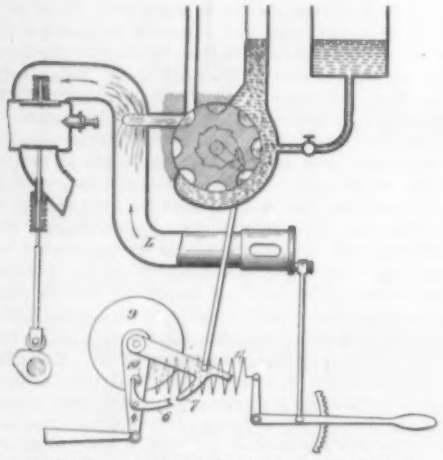


DIAGRAM OF GOBRON-BRILLIE CARBURETER.

The locomotive consists of a substantial steel frame mounted on suitable track wheels. Into this steel frame are mounted two steel sprocket or traction wheels, which are driven by an electric motor contained in the body of the locomotive by means of suitable gearing. The sprocket or traction wheels, which engage the third rail, serve the double purpose of driving the locomotive along the track and taking up the electric current from the third rail to feed the electric motor, the track rails being used as the return conductor. The locomotives of this system now in operation are of 30, 60 and 120 horse power. The company is prepared to build locomotives of this type up to 240 horse power or larger if desired.

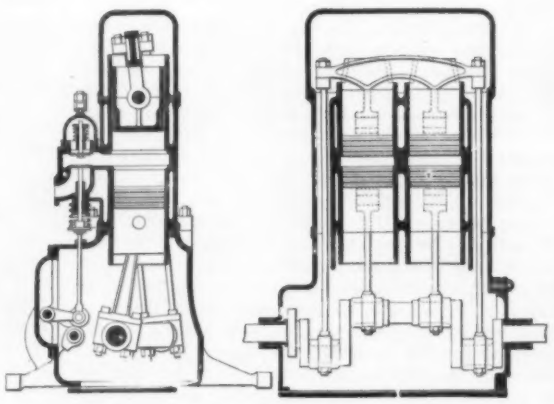
ALCOHOL AUTOMOBILES AT THE PARIS ALCOHOL EXHIBITION.

I. THE GOBRON-BRILLIÉ.

BY OUR PARIS CORRESPONDENT.

The Paris Alcohol Exposition, held under the auspices of the Minister of Agriculture, has proved a great success. The Grand Palais presented the unique sight of a great variety of apparatus, all of which used alcohol to accomplish widely varying results. At one end was a large collection of fixed motors, many of them at work, and at the other were the automobiles, either in the stands or going through their evolutions around the race-track in the center. Then came the lighting and heating appliances. The show was preceded by a series of official tests, which took account of the consumption of alcohol and general performance, and afforded valuable data on the subject. The progress of the alcohol motor is surprising when it is considered that the industrial application of alcohol dates only a few years back. In 1894-5 it came into use for lighting in Germany. At the first Criterium of alcohol automobiles held at Paris in 1899 only 4 vehicles were entered, and but one covered the distance Paris-Chantilly. The Paris Exposition showed scarcely anything but a Koerting fixed motor and a De Dietrich automobile. Last year's Criterium, however, brought out no less than 40 automobiles, and most of them made Paris-Rouen without difficulty. Then came the automobile show of last winter, at which several machines were on exhibition. The present show has a great number of alcohol automobiles, built by the leading Paris firms. Most of these machines use a mixture of alcohol and gasoline in equal parts.

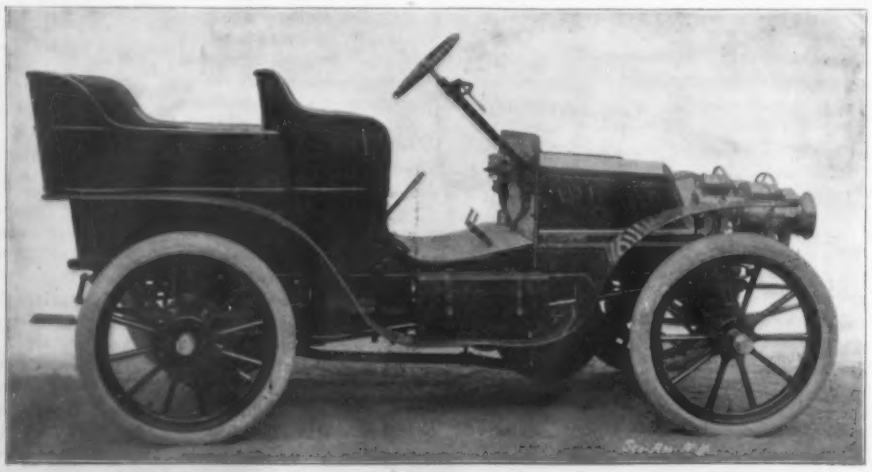
Among the most characteristic and original systems is that of the Gobron-Brillié Company. M. Brillié is recognized as one of the pioneers in alcohol work and was one of the few to be represented in the preceding show. The carbureter is designed on the atomizer principle, and so disposed that a definite quantity of liquid (alcohol and gasoline in equal parts) is atomized at a time in the presence of a determined volume of air. The carbureted gas drawn into the cylinder thus remains constant in quality under varying conditions of speed, etc. The arrangement of the carbureter is shown in the diagram. The main distributing wheel carries on its periphery a series of pockets of a determined capacity. As the wheel revolves these become filled with the liquid and are successively brought before the orifice on the left, which communicates with the atomizer nozzle and with an air-pipe above. The atomizing action is brought about by the suction in the large pipe, *L*, below, and the liquid is vaporized and mixed with the air in a definite proportion. It is found that for a constant volume of air (corresponding to a cylinderful) a constant volume of carbureting liquid is needed. A proportion of 1.05 to 1.10 in 10,000 by volume answers equally well for gasolines of different specific gravity and also for the 50 per cent mixture of alcohol and gasoline usually employed in the alcohol motors. In the case of pure alcohol this proportion gives a slightly less power. The distributing wheel is made to advance by a ratchet whose teeth equal the number of pockets. The ratchet is pushed by a pawl which is operated from an eccentric on the motor shaft through the intermediary of the regulator, *R*. This latter device is ingenious and simple, and serves to give different speeds to the motor. The eccentric gives the lever a back-and-forward movement to the right and left, and this oscillation is transmitted to a weight, 9, held in place by the spring, 11. The weight carries a pin, 10, which is held by the spring against the right-hand side of an opening in the lever. The weight is loose on the shaft, upon which it is given a slight reciprocating movement. The lever has a trip, 6, whose vertical arm rests against the pin, while the horizontal arm may strike against the point, 7, of the upper lever, which carries the driving rod for the ratchet. If the speed of the motor tends to exceed that which is regulated in advance by the tension of the spring, 11, the weight, owing to its momentum, is displaced to the left and the pin pushes the vertical arm of the trip. The lower arm, 6, is thus lifted and escapes the point, 7, of the lever, and this throws the ratchet out of action until the motor comes back to speed. The spring is regulated by a hand lever which gives speed variations between 300 and 1,400 revolutions per minute.



SECTIONS THROUGH GOBRON-BRILLIÉ MOTOR.

It will be remembered that the aspiration is produced in the pipe, *L*, and to carry this out properly it is necessary to regulate the admission of air at the extremity of the tube to correspond to different speeds. For this the tube has a cap with openings which is operated by the same lever. This is not to modify the carburetion, but simply to change the air-draught for the atomizer. To provide for the escape of air the carbureter must either be open at the top or connected above with the main reservoir. The motor, shown in section, has two cylinders and two pairs of pistons, the explosion taking place between the two pistons.

We expect to show some of the other forms of the French alcohol vehicles and carbureters in a later issue.



THE GOBRON-BRILLIE 12-HORSE POWER ALCOHOL TONNEAU.

The new plant of the Gruson Iron Works at Eddystone, Pa., was put into operation on October 21. The works will produce the Gruson coast defense turrets which are at present made at the Krupp works in Germany, although the manufacture of all kinds of heavy castings will be engaged in.

METHOD OF LIGHTING THE GREAT WATER TANK AT THE NOUVEAU CIRQUE, PARIS.

The Nouveau Cirque is the only place of amusement in Paris where it is possible to present nautical spectacles, and, since its organization by M. Zoller in 1886, it seemed to have exhausted pretty much everything capable of interesting the public in this order of amusement until a couple of years ago. At this period, M. Houcke, the director, found a subject, which, although not new, served as a pretext for a very interesting stage setting, and in which M. Mercier, the skillful engineer of the house, was obliged to display all his knowledge of both hydraulics and electricity. It was a question of exhibiting to the spectators a fishman, or rather a diver, who remained under water as if he were at home in that element.

Good divers are not very rare. Those are considered very good who remain under water for two minutes, but some have been known to remain for five.

Respiration, physiologically speaking, does not consist solely in motions of inspiration and expiration of the sides and diaphragm, for that is the mechanical side of the question merely. There is also a chemical side which is no less important, and which consists in the exchange that is effected between the oxygen and carbonic acid of the blood corpuscles that inundate the pulmonary surface.

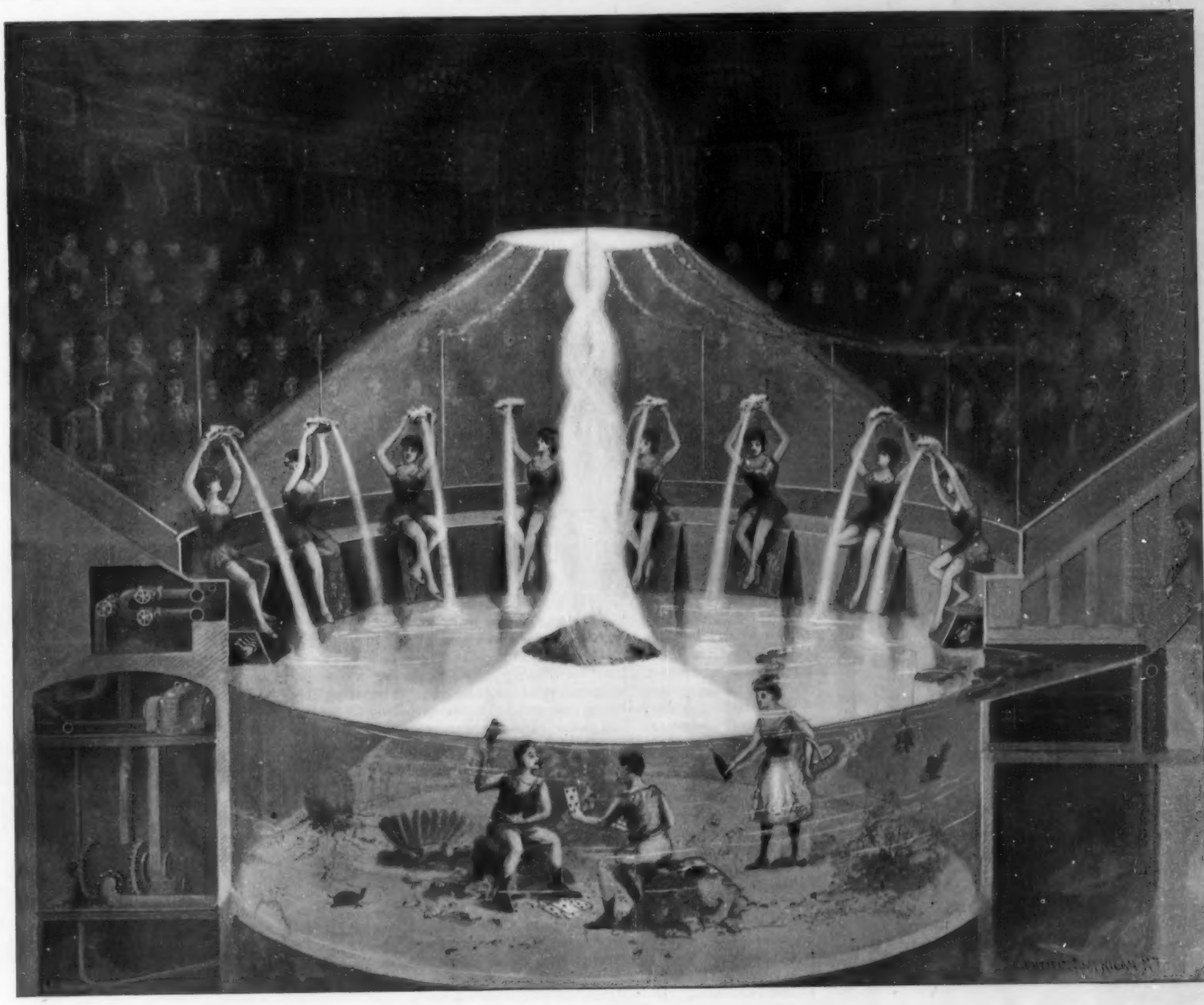
Professional divers are drawn to the surface at the end of a time fixed in advance for each of them, and which is watched by their companions, chronometer or sand-glass in hand. Three-minute sand-glasses are quite frequent, while five-minute ones are very rare. Before submerging himself, the diver takes deep inspirations of air for about ten minutes, the object of which is to store up oxygen, not in the air cells of the lungs, but in the blood corpuscles. In this way there is obtained a special respiratory capacity of the blood.

The diver Benett, who appeared at the Nouveau Cirque, remained 5 minutes and 27 seconds under water on one occasion. Such a feat is very rare, however, and Benett was not allowed to perform it before the public lest it might prove fatal to him. He remained at the bottom of the tank for about three minutes playing cards with a companion who came to visit him, and pretending to partake of a breakfast brought to him by a young woman, who also was amphibious. A hundred or more large sized carp that swam about the group dispelled all suspicion as to any trickery. In order that these fish might remain "en scene," and not conceal themselves in the nooks and corners of the structure, the tank had to be surrounded by panels of open-work metal which they were unable to surmount. In the day time, they were kept in a sort of fish pond which communicated with the tank through a narrow aperture. At first, it was necessary to use nets to drive them from their pond and make them re-enter it, but, after a few representations, these actors got used to the "boards," and made their exit and entrance of their own accord.

In order to render it possible for the divers to remain at the bottom of the tank, which was 8 feet in depth, they were weighted with pieces of lead, from which they freed themselves when the moment arrived to regain the surface.

In order that the spectators might not lose anything of what was going on, it became necessary to find a method of rendering luminous the mass of 184,800 gallons of water in which the divers maneuvered. This was not as easy a matter as might be thought.

At first, the idea suggested itself to install arc projectors under the water; but, since the light thus obtained would have been localized in the zone of propagation of the pencil emanating from the lens, and the effect would have been bad, recourse was had to a very large number of luminous centers given by incandescent lamps distributed around as well as in the middle of the tank. Care was taken not to submerge them, on account of the difficulty of maintaining an insulation under such conditions, especially in a movable material of which the place was changed every evening. They were therefore placed as near the surface as possible. Under such circumstances, the light was very intense, and was distributed in a homogeneous manner throughout the entire mass, and the spectator could not see whence it emanated. The electric installation comprised 250 incandescent lamps of 32 candles each, concealed in 18 boxes that rested upon the circumference of the tank, and were covered externally with movable painted canvases that were changed at the desired moment so as to form a decoration in harmony with the ballet scenes represented before the submersion of the stage. At the moment at which this operation was performed, the dancers arranged themselves upon the top of the railing surrounding the ring, and the boxes floated upon the water. The latter were ballasted in such a way that the lamps which they contained came very near the surface. They were connected with each other electrically, and the current was led to the circuit by a flexible cable that a plug permitted of branching at the desired moment upon the general distribution of the establishment. The interior of each box was provided with reflectors that sent all the light to the bottom, which was white. This latter was covered with rubber cloth cemented to the floor and provided with apertures for allowing the water to pass at the moment of the immersion. In order to light the center, 40 lamps were arranged on an inverted cone of metal suspended in such a manner as to graze the water, by means of a cable starting from the loft above the stage and leading the electric current. The effect obtained was very curious. The water seemed to become luminous of itself, as if it were phosphorescent, and the spectator lost no detail of what was going on in the tank. At the end of the representation, at the moment of the apotheosis, an arc lamp of 30 amperes was lighted at a height of 33 feet. This was concealed by a translucent fabric forming a sort of umbrella mounted upon a jointed frame that permitted of its being closed when it was not in use. Its proportions were so calculated that the luminous rays could not directly reach the spectator, who was thus immersed in a diffused light, while the surface of the tank and the jets of water were brilliantly illuminated. There was thus obtained a revolving jet that fell from the covering of the arc lamp, 32 wheat-sheaf jets that started from decorative motives that flanked upon the water, and 20 jets that flowed from shells held by the dancers seated around the tank.



A SUBMARINE GAME OF CARDS AT THE NEW CIRCUS, PARIS.

A New Patent-Selling Scheme.

More than once we have had occasion to call attention to the numerous traps skillfully laid for the unwary inventor by promoters and brokers whose ostensible business it is to assist him in selling his patent rights, but whose actual purpose it is to fleece him to his last dollar, if possible. An inventor who has been once shorn is not apt to be caught a second time; the lesson has been too dearly paid for. But since not every inventor takes out two patents, it will not be out of place briefly to refer to one of the most recent schemes for inducing an inventor to part with his money.

The inventor, whose name and address have been published in the Official Gazette, together with a picture of his device, and a copy of his allowed claims, will receive from a New York firm of "designing, constructing and consulting engineers" a polite letter in which it is stated that something like the device in question is wanted in Europe. Contrary to the usual practice, the firm admits with refreshing candor that it has no facilities for disposing of the article itself. Nevertheless, it is willing to undertake the sale of the patent on a commission basis. This tempting offer is not without its results. With pardonable eagerness the inventor replies, giving as full a description of his invention as he can, and an account of its merits as he sees them. Then comes a comparatively harmless letter from the firm of brokers, holding out a most alluring bait to the inventor. The firm has read the inventor's communication "with interest." It believes that the device could be developed in certain foreign countries, and graciously offers its services in selling patents in those countries. It truthfully confesses with disarming frankness that the disposal of the patents must be effected partly at the inventor's expense. But the firm is generous. For a certain commission to be paid on sales actually made, it magnanimously undertakes to share with the inventor part of the expense incurred in taking out European patents. How much the firm is willing to contribute toward the cost of the patents is stated in terms the liberality of which must seem to the inventor above reproach. The inventor is requested to pay the remaining sum. After a display of such touching generosity, how can he refuse? His invention is undoubtedly valuable. His doubts, if he ever had any, have vanished. Why the offer to share the expense of foreign patents if the invention were worthless?

Curiously enough the countries stipulated by the firm are those in which patent fees are low and those in which the languages the people are considerate enough to speak are so exactly alike, that only one specification need be drawn up. If the offer to share the patent expense is critically examined, it will be found that the share which the inventor is required to pay not only meets the actual expenses but leaves a liberal profit to the firm. We have called attention to this scheme for the reason that it has been so cunningly devised that an inventor unpractised in the ways of promoters will surely be ensnared, and for the reason that we have received a great number of letters from inventors upon this matter we feel it our duty to explain the system in all its workings. The worst feature of the whole scheme is the fact that because of the prior publication of the U. S. patent the foreign patents so secured will be void and the money spent in securing them might with better advantage be used in lighting the fire.

Working of Patent Acts.

Prof. R. H. Thurston in a recent number of Science discusses the patent laws of various countries in a manner which is both interesting and instructive. Probably no single influence, says Prof. Thurston, has had more to do with the advancement of the industrial interests of the United States and with the resultant prosperity of the nation than the Patent Acts. They were fundamental elements of primary legislation on the organization of the government, and Hamilton and other of those early statesmen to whom so much is due initiated a patent system as a first and most effective instrument in the development of manufactures in a country previously deprived of those industries through the repressive legislation of the mother country. The patent system of the United States became a model for the world, and, very slowly, but none the least steadily, other nations, one by one, took up its most distinctive methods. The United States promptly secured a lead, as great in its field as has become, meantime, that of Germany in industrial education. During late years, the patent system of Great Britain, formerly exceedingly crude, costly to the inventor and the nation, and in all ways unsatisfactory to those who were unselfishly and honestly interested in the advancement of British trade, has been greatly modernized and liberalized; but it has not, even yet, been made fairly comparable with that of the United States.

An important commission, appointed by the Board of Trade and composed of some of the ablest experts and best known men in the kingdom, has just reported upon its operation, and it is perhaps possible to deduce from this report conclusions that may be useful in promoting the still further improvement of our own system, of late years reduced rather than improved in its efficiency by legislation and by official interpretations of doubtful provisions of law. After examining into the operation of the British patent laws and receiving the testimony of officials of the patent office, of referees, litigants, users of patented articles, patent agents and experts, the commission reported.

It was found that, of patents issued, only 57.6 per cent were actually novel and unanticipated by previous invention. Nearly 7 per cent had been fully anticipated in all details; 35 per cent had been partially anticipated; a few were claims on old devices and others described no method of manufacture. Forty-two per cent had thus been anticipated, in whole or in part.

The commission states its opinion that the granting of invalid patents is thus a very serious evil and one which should be at once abolished. A method of examination like that of the United States Patent Office is recommended, and a scrupulous system of detection and elimination of anticipated claims. It recommends, however, a curious limitation: That "the publication of an invention in specifications of letters patent granted in the United Kingdom dated fifty years or more previous to the date of the application, or in a provisional application, of any date, of the kind before mentioned, shall not in itself be deemed an anticipation of the invention."

It is recommended that time, not to exceed two *months* (*one year's* time is given in the United States Patent Office) should be allowed for amendment of a claim, and that a system of appeal, very like that long in operation in the United States, be allowed in case of rejection. This provision, restricting amendment to a period of two months, if it had been adhered to in the United States, would have prevented the litigation now in progress over the Berliner and other patents in this country, and would have saved a vast amount of expense to the litigants and insured a larger employment of inventions in improvement of existing practice and would have saved enormous injury to patentees and to the nation.

This British commission also considers the matter of compulsory licenses. It often happens, in that country, as in this, that valuable patents are purchased by wealthy and powerful interests and simply held, unused, to prevent their competition with the holders and to evade that serious difficulty often met with in the compulsory replacement of existing and fairly satisfactory apparatus by the improved device. Every great corporation and many smaller organizations hold patents thus concealed and out of use, until their own special interests make it desirable to put them into use; and the public is thus defrauded of all that advantage, meantime, which is its proper compensation for the establishment and maintenance of a patent system. The British patent laws have, for nearly twenty years, provided, as have *not* those of the United States, against this abuse. It is made the duty of the proper officials to grant an order compelling the holder of the patent to grant licenses on terms to be adjudged fair and equitable by the proper government officials. This provision has been subject to some criticism in its details, and the commission advises its amendment and improvement; adhering, however, to the underlying principle that the public should not lose its rights or the advantage assumed to be gained by it when providing the legal forms of a patent system and of protection to the inventor. It is recommended that the "High Court" shall receive and consider complaints reciting the facts, if they so prove, that the applicant is interested in the invention, that the reasonable requirements of the public have not been satisfied, by reason of the refusal or neglect of the patentee to work, or to grant licenses to work, the patent, and that the court, if the assertions of the claimant appear to be justified by the facts, shall make an order conferring a license upon the applicant on terms found by the court itself to be just and reasonable.

Reciprocity in patent matters is advised as between Great Britain and other countries prepared to offer similar facilities and protection for the foreign patentee. It would be an excellent reform could a real international reciprocity, based on the best practice of the United States, be arranged to include Germany, which country has illustrated some very objectionable and inequitable patent law methods.

Should the recommendations of the commission be accepted and the British office be reconstructed as proposed, it will provide as practically satisfactory a system of protection as does that of the United States; changing thus from one of the most useless to one of the best of patent systems of the time. It will be interesting to note whether Great Britain, after all, will ultimately provide a more equitable system in regard to purposely delayed issues and unworked patents—the two main defects and abuses of the existing law of the United States—than our "pioneer" code now offers. It will be most discreditable if our committees of Congress and our Commissioners of Patents do not initiate, and Congress perfect remedies for these two radical and inexcusable defects in our own patent law.

The Inventor of the Thermometer.

Like many another invention, before and after it, the origin of the thermometer is rather nebulous, although the instrument has hardly been known for more than 300 years. As a general rule this invention is ascribed to Cornelius Drebbel, who lived in Alkmaar, in North Holland. The date of the invention is usually given as 1638. Viviani and Castelli have refuted Drebbel's claim and ascribed the invention of the thermometer to Galileo, giving the year of the invention as 1597. In a recent monograph published by H. C. Bolton, the results of Viviani and Castelli's investigations are confirmed, with the exception, however, that 1592 is fixed upon as the date of invention. The instrument which Galileo invented seems to have been an air thermometer; at all events such is the reasonable conclusion to be drawn from a description published by P. Castelli in 1638. A pupil of Galileo, Sagredo, mentions a device for measuring heat as early as 1613 and ascribes its invention to Galileo. Sanctorius, a contemporary of Galileo's, speaks of the thermometer "as a very old instrument." The thermometer received its present form at the suggestion of the Accademia del Cimento of Florence; and Grand Duke Ferdinand II. used such an instrument in 1641 in carrying out experiments in incubation. At that time various cities in Italy had become more or less familiar with the new device for measuring heat. In 1662 Robert Boyle exhibited a thermometer to the Royal Society. Hooke was the first to determine the zero point of the scale so that it could always be ascertained, the standard used being the melting point of ice. The second fixed point was determined by C. Rinaldini in 1694. The use of mercury as a thermometric fluid was known to the Florentine academicians. The most accurate mercury thermometers were first made in 1714 by Fahrenheit at Danzig. In spite of the manifest inadequacy of the Fahrenheit scale, it is still used to this very day in England and North America.

Electrical Invention.

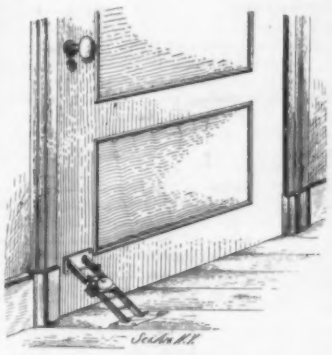
In reply to those critics of the progress of electricity who have reached the melancholy conclusion that invention is on the wane, that the great progressive steps in the development of electricity have all been taken, leaving to inventors of this generation only the insignificant opportunity of improving upon the work of their predecessors, our contemporary, The Electrical Review, asserts that never before in the history of the electrical arts has the activity of inventors resulted in such an outpouring of patents and such a bringing to the surface of new devices and new ideas as at present. It is true that we have failed to develop anything very revolutionary in the last six months, but the 20th century has already started in with a notable record in electrical invention. Since the beginning of the year a number of patents have been granted by the United States Patent Office, which seem in the light of contemporary observation, at least, to cover masterpieces of invention. It is necessary to mention only the Nernst lamp, the Pupin telephone circuit and the Edison storage battery. With an increase of the field of operations for electricity the prospects for radically new inventions become more and more promising. Every new development brings with it a source of new possibilities and points the way to new directions of endeavor.

Agricultural Implements Wanted for an Agricultural Museum in Cuba.

The Department of Agriculture is in receipt of a communication from Mr. R. J. Alfonso, agronomical engineer in Cuba, and secretary of the provincial "Junta" of agriculture, commerce, and industries of the Province of Puerto Principe, in which he expresses his desire to be brought in contact with some of the leading manufacturers of agricultural implements in the United States in the hope that some of them may be induced to contribute to the agricultural museum his association is in process of organizing, some of their implements, or models of the same. He expresses the hope that their enterprise and liberality in this respect would not go unrewarded, as such exhibits would serve a very useful purpose in the way of advertising their manufactures. Mr. Alfonso's address is Puerto Principe, Cuba.

SIMPLE, INTERESTING INVENTIONS.

BURGLAR ALARM.—A simple burglar alarm which can be applied to any door is the subject of a recent patent. The burglar alarm consists of a main frame engaging the floor. On the main frame a clock-train is supported which is released by the motion of a frame sliding in the main frame. A socket plate is attached to the door, and serves as a supporting means for the sliding frame. When the door is pushed open the sliding frame is moved, the clock-train is released, and an electric bell immediately begins to ring. The construction is such that the alarm cannot be detached from the door on the outside. The alarm mechanism can be disengaged only by raising the main frame from the floor.

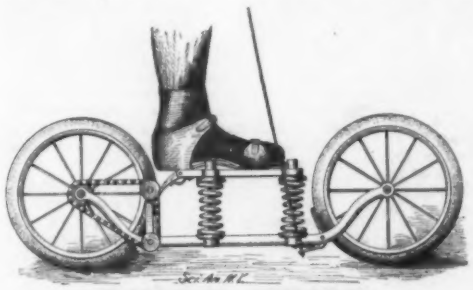


A SIMPLE BURGLAR ALARM.

BARREL.—A simple method of permitting a farmer to inspect the contents of his fruit barrels is an invention which is illustrated in the accompanying engraving. The invention consists in providing one or more of the staves of a barrel with a longitudinally-split tongue, the very end of which is held securely in place by the hoop, but which can be released and opened to permit an examination of the contents by displacing the hoop.

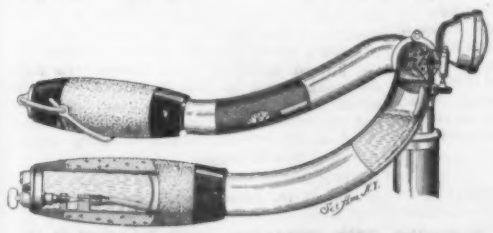
A NEW FORM OF BARREL.

ROLLER SKATE.—The force expended in pressing downwardly on a skate is ordinarily wasted. Paul Jassman, of Brooklyn, New York city, intends to utilize this downward pressure in a novel skate of his invention, comprising a frame in which front and rear wheels are journaled and on which guide-posts are supported for the purpose of receiving a sliding foot-rest. Springs are coiled around the guide-posts and hold the foot-rest in an upper position. A spring-pressed pawl is secured on the rear of the foot-rest, which pawl, on the downward movement of the foot-rest, imparts movement to a sprocket-chain by which the rear wheel is driven.



CHAIN-DRIVEN ROLLER SKATE.

BICYCLE HANDLE-BAR GAS-GENERATOR.—Two Chicago inventors think it would be a good idea to use the hollow bicycle handle-bar as a carbid and water compartment for an acetylene bicycle lamp. In carrying out this idea the handle-bar is divided into two chambers, the one constituting a water receptacle and the other a gas-generating chamber, containing the carbid packed in a porous bag. Between the water and carbid compartment is a gas-chamber having an outlet with which the lamp is connected. The water and carbid chambers are connected by a conducting pipe, the passage of water from the water chamber to the carbid chamber being controlled by a valve operated from one of the handles.



HANDLE-BAR USED AS AN ACETYLENE GENERATOR.

FOLDING DECOYS.—To the duck hunter the matter of the transportation of his decoys is a serious one for the reason that as these things have been constructed they are necessarily bulky, even though they are not heavy, and to get them from point to point has always been a matter of serious consideration to the gunner, especially as there is his gun and other necessary paraphernalia to be carried.

THE DECOY-DUCKS PACKED.

The folding decoy shown in the accompanying cuts has been invented by Joseph Coudon, of Aiken, Md., an old Chesapeake duck hunter, who for many years has made a study of both the ducks and the decoys which are used to lure them within the reach of the gun. The decoys are made of wood and painted, and are arranged in groups of three. When they are unfolded for use the three decoys are separated, and held in this position by a hinge-like device of wire which is clearly shown in one of the accompanying cuts. The center and forward bird is supplied with a float which supports all three, allowing them to float on the water all at the same depth in a very lifelike manner. The forward one is also supplied with an anchor which holds them in place against the action of the wind and tide, and when it is desired to collapse the dummies for packing or shipment, this anchor, being loop-shaped, slips over the neck portion and holds them firmly together.

THE DECOY-DUCKS IN USE.

Substitutes for Rubber.

Three Viennese inventors, C. and R. Paulitschky and F. Wueste, have patented a new substitute for rubber. Sole leather is disintegrated by machine until the material is reduced to partially connected fibers. By soaking and agitation for a considerable time in tanner's dressing (bruised barley, leaven, and water) these fibers are softened. After drying, the mass is steeped for some time in train-oil freed from acid by treatment with warm water (Lederoel). Cork in pieces as large as hazelnuts is boiled in the thickened root-sap of the Landolphia plant to make it elastic and durable, then dried slowly. In moderately-sized lumps the waste rubber is boiled for fifteen minutes in a one or two per cent solution of caustic acid. "Rubber-linseed oil" is then prepared by dissolving about ninety-five parts of rubber in five parts of linseed oil at a temperature of 40 deg. to 60 deg. C. These materials, together with asbestos, are mixed together in proportions which have been established by the inventors. The product is placed in calenders having adjustable heated rollers, and is finally treated with sulphur chlorate diluted with carbon bisulphid for the purpose of vulcanization. The finished material is said to possess greater elasticity and durability than the rubber substitutes which have been hitherto manufactured.

Exhibition of Women's Inventions.

In the Woman's building of the South Carolina Interstate and West Indian Exposition, to be held in Charleston, S. C., from December 1, 1901, to June 1, 1902, there is to be an exhibit of women's inventions. The Committee on Inventions will be pleased to furnish all particulars to women who desire to place models on exhibition.

A Nicotine Insect-Destroyer.

In order to exterminate insects or mildew in gardens, compounds are employed which, upon being subjected to heat, are vaporized. The vapor thus generated is the medium by which insects and mildew are destroyed. One of the chief constituents of such compounds is nicotine, which is usually mechanically combined with absorbents, such as clay or lime, and formed into a paste for commercial purposes. These compositions present defects. After all the nicotine has been vaporized a quantity of residuum is left, which corrodes the receptacles in which the vaporization has taken place.

A new nicotine-containing compound has been invented by an Englishman, Mr. George H. Richards, of London, which can be used and commercially sold in the form of a powder or compressed cakes or tablets, and which is so completely volatile that no residual matter is left. The inventor has found that highly purified nicotine can be combined with salicylic acid to form a solid crystalline salt, and that this salt is entirely dissipated by heat and is extremely suitable for vaporizing compounds by reason of the insecticide property of nicotine and the germicide property of salicylic acid. It is claimed that no residue is left in the receptacle in which the vaporization is carried out.

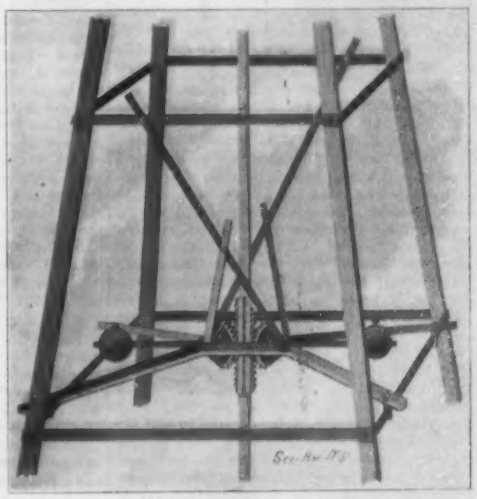
British Inventiveness.

Home Secretary Ritchie recently compared the British with the American inventor, much to the disparagement of the former. The Home Secretary has thus brought down a hornet's nest about his ears, and has been rather summarily convinced that his countrymen are by no means laggards in invention. If we refer to the Report of the United States Commissioner of Patents for the year ending December 31, 1899, we find that 38,937 applications for patents were made in the United States for the same period that 25,786 applications were filed in the English Patent Office. When it is considered that the population of the United States at the time given was considerably above 62,250,000, and that the population of Great Britain and Ireland was recorded as 37,732,922, it is evident that Englishmen are fully as active as their American cousins. If these figures be correct, it would follow that there is one invention filed for every 1,600 persons in the United States and one for every 1,075 in Great Britain.

A Novel Pump-Rod Balance.

Pump-rods operated in deep wells by windwheels or any power are usually balanced, the object being to increase the power and materially aid the operation of the windwheel on the upper stroke of the rod. An improved balance for such pump-rods has recently been patented by Arthur A. Koch, of Montezuma, Iowa.

The pump-rod is provided on both sides with racks meshing with segment-gears respectively carried by arms on which weights are adjustably mounted. The object in making the weights adjustable is to provide for the force or power of the windwheel and to balance the weight of the water and the pump-rod, which weight varies in different wells. These weighted segment-gears are mounted to swing in a frame comprising two sections, the outer ends of which are provided with hook bolts for engaging with cross bars of the tower. The braces are connected with short braces extended from the frame. By reason of this construction the tower and its appurtenant parts are stiffened so that the pump rod and segment-gears will operate in a structure which is as rigid as it can be made.



A NEW PUMP-ROD BALANCE.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

FOLDING PLATFORM FOR GRAIN-BINDERS.—JOHN J. SCHAILL and ALEXANDER G. LEVALLEE, Tusler, Mon. The platform can be conveniently folded up to occupy a small amount of room so that the binder can pass through a space as small as that required for the passage of the wagon. This result is attained without adding materially to the weight of the wagon. The binder-platform can be folded or unfolded on the field by a boy capable of driving a team.

HARROW.—THOMAS L. FLYNN, Bronx, New York city. This implement will harrow and roll the ground at one operation. The construction includes a rapidly-moving harrow-frame driven from the axle of the machine, effecting a quick and thorough pulverization of the ground. The inventor has provided a simple steering-gear under the complete control of the driver, and means whereby the harrow-drum and roller can be simultaneously raised and lowered, the harrow-drum, when elevated, being simultaneously thrown out of gear with the driving mechanism.

Engineering Improvements.

BOILER.—JAMES H. ABRAHMITH, Colfax, Wash. This invention relates to a direct-flue steam-boiler, designed principally for use with straw fuel. Such boilers are usually employed for agricultural purposes, as for supplying the engines which drive threshing-machines, straw being employed for fuel by reason of its cheapness. The construction of the present boiler permits it to hold more water than others of the same exterior dimensions.

STEAM-BOILER.—EDWARD VAN KEUREN, Poughkeepsie, N. Y. The boiler is a locomotive-boiler having a greater water-heating space than is provided in the usual form of boilers. A water-jacket is attached to the flue-sheet and surrounds the flues, the water-jacket being extended forward into the heating-chamber. The water will pass from the boiler into the jacket, so that it is completely surrounded by heat. The inventor has provided not only a larger water space than usual, but also a larger heating surface.

Electrical Apparatus.

TELEPHONE ATTACHMENT.—JOHN A. RICE, Riland, New Mexico. It has been Mr. Rice's purpose to provide an automatic relay for the operation of vibrating electric bells remote from the telephone, such as in different parts of a machine-shop, where a loud or distinct alarm is necessary to call attention to the telephone.

ELECTRIC MOTOR.—JOSEPH DARLING, Chicora, Pa. The present invention is a simplified construction of a motor which Mr. Darling patented in 1900, the purpose being to facilitate the assembly of the parts and to cheapen the construction so that the motor can be sold as a toy. The novel features of the present invention are to be found in a peculiar, simple method of casting the framework and in a novel arrangement of operating parts.

CONTROLLER FOR ELECTRIC CARS.—BARTON W. SCOTT, San José, Cal.—The invention is an improvement in devices for controlling the brake mechanism of an electric car and for regulating the electric current. Both the brake and current are quickly controlled by the operation of a single lever instead of the operation of two levers, as in the usual way. Thus the time required to stop a car is shortened in case of danger and the possibility of confusion on the part of the motorman avoided.

INTERRUPTER.—DR. R. H. CUNNINGHAM, 200 West 56th Street, Manhattan, New York city. This invention is a mercury-jet interrupter for use with induction-coils in actuating Roentgen-ray tubes. Unlike the well-known turbine, mercury-jet interrupter and that of Boas, Dr. Cunningham's apparatus contains no fluid non-conductor, such as alcohol or oil, both of which prolong the arc at the break, rapidly carbonize and contaminate the mercury, and are in great danger of catching fire, if heavy currents be employed. No fixed brushes convey the current to the moving parts. When it is desired to vary the duration of the make without altering the period, thus varying the intensity of the primary current employed, the necessary adjustment can readily be performed from the exterior. Thus the frequent opening of the apparatus and the constant risk of inhaling at such times noxious mercury vapor is avoided. As in other mercury-jet interrupters, the mercury in time becomes contaminated by a certain amount of oxid and metallic mercury in the form of very fine dust, which may be readily removed and distilled to yield the original liquid mercury.

Printers' Supplies.

METAL-POT FOR CASTING PRINTING-PLATES.—LEO GROSSMAN, Brooklyn, New York city. The invention provides a new and improved metal-pot arranged automatically to supply molten metal to one or a number of casting-boxes in a perfectly pure condition and in a very simple manner without the aid of a skilled hand. From the pot an outlet spout leads to form a gravity discharge for the metal. The discharge mouth on the spout is slidable thereon to connect with or disconnect from the casting-box or mold.

PERFORATOR FOR PRINTING PRESSES.—GEORGE and ROBERT KENNEDY, New Westminster, B. C., Canada. The perforator includes a bar arranged to be locked up in the form or chase. A shaft is mounted to turn on the bar and has perforating devices. On one end of the shaft a crank-pin is attached to the journal. A driver is mounted to slide in a casing at one end of the bar and is provided with a cam-groove having a partly-straight and a partly-curved course, and engaged by the crank-pin, so as to bring the perforating device into active position in advance of the impression. A spring presses the driver. And a spring device is carried by the platen to press the driver against the tension of its spring.

Mechanical Devices.

DEVICE FOR REGULATING SPEED.—CHARLES O'CONNOR, Greenpoint, Brooklyn, and GEORGE C. AHRENS, Blissville, Queens, New York city. The speed-regulating device is especially adapted to power-pump machinery. The purpose of the invention is to provide a simple mechanism for changing the speed of power machinery without changing the diameter of the driving-pulley or interfering with the pulley or the driving-belt in any manner. On the drive-shaft a cone of gears is mounted to slide and turn with the drive-shaft. A worm-gear is provided to adjust the drive-shaft and the driven shaft to and from each other. A gear carried by the driven shaft is adapted to mesh with any gear in the cone of gears.

SPOKE-TENONING MACHINE.—DEFIANCE MACHINE WORKS, Defiance, Ohio. Mr. Charles Seymour has invented for the Defiance Machine Works a novel machine designed for the use of spoke, wheel, and wagon manufacturers to dress the ends of the spokes so as to fit the mortise in the wheel-hub. The machine is comparatively simple and durable in its construction; very accurate in operation to insure uniform work; and arranged to handle large and small spokes, and to cut either a plain tenon or completely to tenon, miter and point a Sarven spoke during the passage of the spoke through the machine. The machine can be readily adjusted to dress spokes of different sizes, shapes and lengths, and to form tenons of the desired thickness and length.

CLUTCH.—THOMAS J. O'BRIEN and HOMER L. ALLEN, Cairo, Ill. The invention is a clutch-pulley that can be rendered fast or loose on the shaft. The construction comprises two clutch members which, in addition to engaging the pulley to hold it fast on the shaft, serve further as a bearing for the pulley on which the pulley is carried to turn when the clutch is thrown out of gear.

EARTH-SCOOP.—WILLIAM MATTHEWS, Peak Hill, New South Wales. The earth-scoop is claimed to be stronger, more efficient and simpler in construction than any now in use. The adjustments are completely under the control of the driver. Any danger of tipping during the operation of filling is avoided. During transit the load is simply and effectively retained. One of the novel features of the invention consists in mounting the earth-scoop so that it may be rotated in the frame. The distance between the axis of the scoop and its front edge is greater than the height of the axis of the wheels from the ground, so that the front edge is caused to enter the ground in such a manner as to overturn the scoop.

CUTTING APPARATUS.—EDWARD A. MAINGUET, Evangeline, La. This cutting apparatus is designed especially for use on reaping-machines. Engaged with the cutter-bar is a lever having an operating-arm. An endless chain has on its outer side a pair of projecting rollers between which the operating-arm of the lever extends. The shafts have sprocket-wheels for supporting and driving the chain. On the shafts are pulleys connected by a drive-belt with a drive-pulley. A tightener is provided for the belt. As the chain moves around, the lever travels with it. The belt is employed for driving the sprockets of the chain evenly and smoothly. The belt may slip in case of unusual stress to prevent breakage of the parts in case the cutter-bar should meet an unyielding obstruction.

STRETCHER.—ADOLFO LURIA, Atwood Building, Chicago, Ill. This improved stretcher, designed for use not only in the field but also in private houses, is essentially characterized by a telescopic frame and hinged handles, which are adapted to fold and to be supported in extended or folded position. By means of the telescopic frame the width of the stretcher can be adjusted to suit varying conditions.

ADJUSTABLE SCHOOL DESK AND SEAT. JOHN M. SAUDER, deceased; Experience L. Sauder, administratrix, Philadelphia, Pa. The desk is an improvement of that class which are provided with longitudinally-slotted standards made in one continuous piece, and with pinions, racks, and nuts for adjusting the desks and seats vertically and for locking them in any adjustment from either side. Mr. Sauder simplified and reduced the number of parts heretofore required to effect such adjustment, and invented a mechanism capable of a more easy and speedy adjustment.

JOURNAL AND BEARING THEREFOR.—HERMAN THEMEL, Escanaba, Mich. The journal consists of a shaft, a ball mutilated for the purpose of admitting the shaft, and a member fitting into the mutilation for the purpose of restoring the rotundity of the ball. By reason of this construction comparatively little lubrication is required.

VEGETABLE CUTTER OR GRATER.—FREDERICK SUELLENTROP, Lynn, Mo. A tray is carried on the upper end of a standard and has an inwardly-turned lip at one edge. In an arm carried on the upright a spindle has a bearing, which spindle is provided with a crank and with a cutter. The vegetables are held by one hand in the tray and against the cutter, which is to be rotated by means of the crank. The lip prevents the upward movement of the material in the tray.

REVERSING MECHANISM.—FRANK C. RICE, Jamestown, N. Y. The reversing mechanism is to be used on washing machines, churns, and other machines and devices to rotate the dasher or other part alternately in opposite directions. The construction is such that friction is reduced to a minimum, and the machine can be run with very little power.

VOTING-MACHINE.—GUSTAF JOHNSON, Pigeon Cove, and JOHN E. HALLDIN, South Boston, Mass. By means of this machine each voter is enabled properly to cast his vote, and registration of the total votes cast for each candidate, amendment, or the like is effected, all in such a manner as to prevent fraud. Broadly speaking, the invention consists of a number of manually-controlled key-spindles located one above the other; a registering device for each key-spindle, operated thereby; a vertical shaft; means for operating the vertical shaft from the key-spindles; a setting device; and mechanism for operating the setting device from the vertical shaft.

COMBINED PUNCH, GRIP, AND WRIST MACHINE.—JOHN HEISSENBERGER, Bronx, N. Y. The inventor has provided a coin-operated machine in which a punching device, a grip-testing device, and a wrist-testing device are combined. All three devices register on one dial. No two of the devices can be operated together, or any other devices alone until a coin of proper denomination has been placed in the machine. When the pointer on the dial is carried to or beyond a certain figure, the coin deposited will be returned to the depositor.

CAN-SOLDERING MACHINE.—JOHN W. GREEN, Astoria, Ore. The invention relates particularly to improvements in the solder or guide bars of can-soldering machines. The object is to provide a bar so constructed and arranged that it will not be perceptibly distorted by expansion, thus maintaining its parallelism with relation to the upper guides and causing an equal immersion of the can-heads throughout their circumference. The chain-holding weights are adjustable.

FELLY-PLANING MACHINE.—DEFIANCE MACHINE WORKS, Defiance, Ohio. This machine is the invention of Mr. George A. Ensign, well known for his many inventions in woodworking machinery. The machine is an improved planer especially designed for simultaneously dressing both sides of felloes for vehicle-wheels to reduce the felloes to the desired width, without the aid of skilled labor. The machine is arranged automatically to feed the felly to and between two adjustable cutter-heads to insure true and uniform planing of both sides either parallel or on a bevel. The cutter-heads can be conveniently reached whenever necessary.

AIRSHIP.—JOHN SPIES, Philadelphia, Pa. In this airship Mr. Spies has endeavored mechanically to reproduce the flight of a bird. To attain this end, his airship is both light and strong. Its wings or propelling devices are located at the most desirable point to effect the movement of the machine. A simple means is provided, under the direct control of an operator for shifting the gravity point, directing motion up or down.

CLOSET ATTACHMENT.—THOMAS A. CAMERON and PAUL T. BEYGRAU, Rossland, B. C., Canada. A water-closet attachment is provided consisting of a long strip or roll of paper, provided at intervals with openings and arranged to be fed over the seat whenever desired.

PULP-GRADING MACHINE.—LEOPOLD ZEYEN, Ragubn, Anhalt, and RUDOLF HAAS, Jr., Mauel (near Gemünd), Germany. The machine sorts paper pulp while it is suspended in water. A series of sieves having different mesh or fineness are arranged in compartments and adapted each to have a limited movement. By this arrangement only pulp of a predetermined grade is collected in each of the compartments; and the separation of the finest grade of pulp is gradual. It is possible to take from each compartment pulp of a proper grade for each particular purpose; and the work to be performed by the finest sieves is reduced, thus minimizing the danger of clogging.

COMBINED CONCENTRATOR, AMALGAMATOR, AND SEPARATOR.—WILLIAM O. JOURNEAY, Austin, Tex. To provide a simple, economical and efficient machine suitable for treating ore or gravel, dry or with water or mercury, is the purpose of the present invention. The ore is received in a chamber at the top, and discharged at the bottom. The chamber is provided with a vertical rotary shaft with a stirrer. The operation of the device is very efficient, and the construction is exceedingly simple.

Tools and Implements.

PARALLEL-RULER.—ANDRÉ BUSTANOBY, Manhattan, New York city. A construction has been devised for conveniently indicating the distance separating the rulers for permitting either of the rulers to be shifted lengthwise in any of its positions, and for effectively bracing the rulers so as to hold them against bending.

WORM-WHEEL CUTTING TOOL.—KARL KNAPPE, Reinickendorf, near Berlin, Germany. A common worm-wheel cutter in the shape of a worm, the winding turns of which are formed by a series of cutting teeth having sides receding behind the cutting edges, is very suitable for cutting worm-wheels. But this tool, being very expensive, has not been widely used. In the present invention the cutting edges of the tool are arranged on a single or several pieces of flat steel secured in the milling-shaft of a machine-tool, whereby the advantage is obtained that the flat steel tube with the cutting edges can be produced in a simpler manner than the worm-wheel cutter. It is easy so to form the teeth of the flat steel tool as to cause their sides to recede behind the cutting edges.

DRILL-HOLDER.—EDWARD P. JONES, Breckenridge, Colo. Mr. Jones has devised means for adjustably holding a rock drill so that it can be placed in any position that may be desired with respect to the column. The holder is enabled thus to be placed in any position by reason of a ball and socket connection.

Railway Appliances.

CAR-SEAL.—GEORGE L. WILCOX and COURTLANDT H. VAN RENSSELAER, Manhattan, New York city. The seal consists of a body portion of box-like construction open at one end, the top of the body portion having an inwardly-turned end forming a hook at the inlet end of the body. A reduced projection or lug on the end of the hook is designed to pass into a slot formed in the hook portion of a shackle having one end secured within the body portion. It would be impossible to release the hook end of the shackle from the hook, because it will be prevented from so doing by the projection.

Miscellaneous Inventions.

GARMENT-HANGER.—PATRICK F. DENNING, Haverstraw, N. Y. The invention is an improvement in devices for supporting or holding garments and is especially adapted for use in theaters, halls and churches. The device can be attached to a suitable support—such as the back of a theater chair or pew—and adpated to hold hats, overcoats and the like. Upon being relieved of the weight of the garments, the hanger is automatically folded against its support.

BRACKET.—JAMES E. CHAPMAN, San José, Cal. The bracket consists of a platform. Extended around and secured to the under side of a rim is a supporting wire terminating in fastening points. The connected ends of the wire extend upwardly at right angles to the platform and the points are to be driven into a support. The bracket will be found useful in many places for supporting matches, lamps, soap, and the like.

METHOD OF PRODUCING PLASTIC ARTICLES BY THE AID OF PHOTOGRAPHY.—MARIO RUSSO D'ASAR, Genoa, Italy. Briefly described, the method consists first in making a photographic negative and a transparent positive of the picture to be produced plastically; then placing this positive and negative with their details in registry and with the sensitized surfaces at a slight distance from each other; exposing a light-sensitive plate or medium to light passed through the combined positive and negative; and developing and fixing the plate and using it for the exposure of a plate sensitized with bichromated gelatin. This plate upon development in water yields an uneven surface from which a plaster cast can be made, which cast then serves for the reproduction of the relief intaglio.

GUITAR.—THEODORE WOLFRAM, Columbus, O. The object of the invention is to provide an improvement in guitars, mandolins and similar instruments whereby the instrument is rendered very sensitive to the touch of the player and the tone is improved both in quality and volume. Mr. Wolfram has made two guitars in accordance with his invention and finds that the lightest touch causes a strong vibration. The tone comes stronger and more easily, and holds out much longer than with the old instrument. Mr. Wolfram, who has been a manufacturer of guitars for ten years, claims that the old instruments were weak when the size of the sounding board was considered. The system of bracing necessary to secure durability killed the tone. Mr. Wolfram extends a lining from the sides of the body adjacent to the top, and places on the under side of the top of the body a vibratory rim spaced from the lining.

BUST FORM.—EMILY H. WRIGHT, Manhattan, New York city. The device is an improvement on a bust form for which the inventor received a patent in April last. The object of the present invention is to improve the former construction so that the bust form will retain its shape for a longer time. To this end the previously patented bust form is provided with an inner portion or filling which conforms to it in shape.

DIVING-DRESS.—FREDERICK H. SPRANG, 86 Grange Road, Bermondsey, London, England. The invention has primarily for its object to enable rubber-coated fabric vulcanized in the

piece to be used, which has not heretofore been possible in consequence of the difficulty of making the seams by which the parts whereof the dress is made up are united.

MULTI-COLORED RUBBER MAT.—FREDERIC N. UPHAM, Brooklyn, New York city. The mat presents at all times a very smooth walking-surface, is subjected to even wear, and is arranged to hold the inlaid rubber tiles securely in place in the rubber sheet or plate. When the rubber mat is in use the inlaid pieces cannot work up in the sheet and be broken and forced out.

CLOTHES-LINE ATTACHMENT.—WILLIAM W. PUMYEA, Jersey City, N. J. The purpose of the invention is to provide a means for conveniently holding the ends of the pulley-lines which are commonly used in large cities. Combined with a clothes-line is a body portion with which one end of the line is engaged to form a bight received in an eye in the other end of the line. A dog in a body engages the line adjustably to hold it.

BUTTON-FASTENER.—HERMANN G. C. HÖRNING, Astoria, New York city. The button-fastener is readily applied to fasten a button in place on a garment without danger of tearing the cloth under an ordinary strain and is arranged to permit the use of the fastener on cloth or apertured buttons. The device is very simple in construction, can be cheaply manufactured, and readily applied without, as before said, tearing or injuring the garment.

HEATING AND VENTILATING APPARATUS.—JOHN F. SIMS, Illiopolis, Ill. The invention is in the nature of a novel construction and arrangement of heating and ventilating register, operating upon the principle of a closed circulation of air currents from a furnace in the cellar up to and through the several rooms of a building and thence back again to the furnace in an endless cycle.

MOUTH-ILLUMINATOR.—EDWARD EBI, Cedar Rapids, Iowa. The device is particularly adapted to the use of dentists and physicians to locate any diseased part. The illuminator consists of a casing arranged to inclose an incandescent lamp. A tube is extended from the casing; and forward of the tube two mirrors are arranged. The mirror nearest the end of the tube is smaller than the other mirror. Arms are extended from the tube; and between the arms and the mirrors are universal joint connections. A device embodying the invention can be quickly applied to an incandescent lamp; and when the lamp is suspended by such flexible connection as wires, the device can be readily moved from place to place.

DENTAL FORCEPS.—JOSEPH B. DAVIS, 727 Julia Street, New Orleans, La. In movable beak forceps heretofore devised the pressure from within outwardly on the end of the beak would tilt it in its socket, and thus have a tendency to loosen the beak in the socket. This invention provides such peculiar construction of joint between the movable beak and the jaw of the hand'e as will make a firm and secure connection which will resist this tendency and which in use will have a tendency to tighten instead of loosen at the joint.

FIREPLACE.—LOGAN B. ARNOLD, Hanly, Ky. Perhaps the feature of most interest in this invention is a back-plate provided on its front face with upright ribs and on its rear face with upright tubes staggered with respect to the front ribs. The tubes are open at their upper and lower ends. By reason of this construction the back-plate is prevented from warping; and the intensity of the fire can be increased so that the heating of the room is improved.

BILLIARD-CUSHION.—SAMUEL MAY, Toronto, Ontario, Canada. This improved billiard-cushion is intended to insure the proper repelling of the balls by the use of two or more graduated springs, so that the force of the ball will cause the steel springs to exert a repelling effort to prevent loss of speed in the ball and to prevent the hopping or jumping of the ball from the table. The use of this cushion moreover insures deflection of the ball at an angle equal to the angle of incidence.

SPRING-HEEL HORSESHOE.—THOMAS CUSDIN, Orrong Road, Armadale, Melbourne, Victoria. The inventor's peculiar construction of horseshoe has been devised with the intention of diminishing concussion. The shoe consists of upper and lower members welded or riveted together at the toe portion, or formed in one piece and divided toward the heel, in order to receive interposed elastic cushions. By this construction the rubber is protected from wear and all the merits of an elastic tread and the consequent avoidance of concussion are obtained without the disadvantage ordinarily resulting from the wearing of the rubber and the loosening of the nails by which the shoe is fastened to the hoof.

INDICATOR FOR SHIPS.—SAMUEL BENNISON, Galveston, Tex. The indicator is designed to show accurately and readily the draft of a vessel as well as any list and pitch. The essential features of the invention are a vertically extending support on which a swing is hung, having a straight lower portion, normally lying horizontal. A level bar is rigidly attached to the support at right angles thereto. On the swing and level bars, spirit-levels are carried. By means of these levels the pitch of the vessel is accurately indicated, as well as the list.

STEEPLECHASE OR HURDLE FENCE.—ANTONIO PASCOCELLO, 174 Grand Street, Manhattan, New York city. The upper portion of the hurdle is composed of a piece of rubber which preferably extends from post to post and is provided on its upper edge with a series of vertical fingers whereby a horse that fails to clear the fence will strike one or more of the yielding fingers and thereby be saved from falling or stumbling in passing over the hurdle. The rubber fingers or pieces return to place after being struck and bent over.

PHOTOGRAPHIC VIGNETTE.—WILLIAM D. CORNELIUS and FRANK L. TODD, Enid, Oklahoma Territory. The inventors have devised a vignette attachment to a camera, which is of novel simple construction, is adjustable relatively to the position of the film or plate held in the camera, so as to terminate the image of a vignetted photograph at any desired point.

JOINING METAL RODS AND BARS.—OTTO SCHULTZ, Berlin, Germany. This improved method of joining metal bars will be found of particular service in forming grates. Heretofore such bars have been joined either by welding or by means of rings, rivets, or screws. The present invention consists in forming an opening in one bar, inserting the other bar in the opening, bending the bar on opposite sides of the opening, and then subjecting the bar with the opening to pressure.

BELT.—CHARLES M. BUTLER, Wonewoc, Wis. The belt is to be used by men and is adapted to be worn upon the trousers to receive the waistband. Cut-out portions fit over the hip and can be adjusted properly to different positions by means of an adjustable fastening at the back of the belt in connection with adjustable fastenings on the front, these coacting in securing a proper fit of the belt.

LOAD-BINDER.—JOHN MORTENSON, Neihart, Mont. The improved binding apparatus comprises a forked lever to which the binding-chain is attached. The chain has a swivel and terminal hook whose slot is elongated and parallel sided. The lever can be secured in the locking position by means of a rope.

LAMP-HANGER.—HERBERT L. WHITE, Bonham, Texas. This electric-light hanger comprises a casing in which a lamp-supporting tube is arranged to slide. Electric conductors extend into the tube, and pass over a pulley in the upper portion of the casing. Means are provided in connection with the conductors whereby a pull can be exerted on the conductor to move the tube upward.

PROCESS OF OBTAINING IANTHONE AND IONONE.—FERDINAND SEMBRITZKI, Holzminden, Brunswick, Germany. The process is based upon the action of phenyl-hydrazin and similar substitution products of ammonia upon ionone and ianthone, the former of which readily forms condensation products with such substitution products of ammonia, while the ianthone is not attacked at all or combines with difficulty with the hydrazins. Thus it is possible to effect the separation of ianthone from the simultaneously formed ionone obtained upon the condensation of citral and mesityl oxid and by the subsequent inversion of the resulting intermediate product.

MATCH-SAFE.—FREDERICK SCHNECKENBURGER, Wilkesbarre, Pa. The match-safe is of such construction that but a single match can be removed at a time and that an alarm is sounded when the match is removed. A sliding device is provided whereby one match at each operation of the slide will be carried from a receptacle through which the slide works, and automatically delivered at the exterior of the safe in such position that it can be quickly and conveniently removed.

CRATE.—JAMES W. SAYRE, Seneca, Mo. This berry, fruit, butter, or egg crate is arranged to hold ice in order to keep the contents cool for a long time during transportation. By allowing air to circulate the contents are kept in a perfect state of preservation for a considerable length of time.

CURTAIN POLE RING.—FRANK PERRY, Brooklyn, N. Y. Mr. Perry has invented for the John Kroder and Henry Reubel Co. a pole ring formed of tubular split rings having the ends fastened together and carrying a depending eye for engagement by a curtain hook. Mr. Perry's object is to provide a pole ring arranged securely to hold the ends of a tubular split ring in position and prevent accidental opening of the ring, and firmly to support the eye. The several parts are fastened together without the use of solder or like fastening devices.

CANDELABRUM.—HENRY F. NEHR, Brooklyn, N. Y. The candelabrum is of such construction that the arms can be quickly and conveniently adjusted to different positions relatively to the standard by which they are carried. Auxiliary standards can be attached to a support from the main standard, and are provided with adjustable candlestick supports. The entire device can be easily set up and as easily dismembered, so that each part can be separately packed in a suitable case.

SHIPPING AND FILING DESK.—CHARLES LOHRMAN, Brooklyn, N. Y. The purpose of the invention is to locate within compartments which may be termed "filing compartments," pliable partitions, so placed that a series of pockets are formed. The pockets are classified alphabetically and numerically, preferably in sections corresponding to those of the cover. To each pliable partition a spring member is applied, which will permit the partitions to be forced to one side when a letter or memorandum is to be placed in a pocket, and which serves to restore the partitions to their normal positions when the hand is removed from the pocket.

TOBACCO PIPE.—EARL D. BUSSERT, Lima, Ohio. The pipe can be very conveniently cleaned. Passage of nicotine from the bowl along the stem to the mouth of the smoker is prevented. Liquid accumulation is arrested and prevented from escaping at the tip end of the pipe stem into the mouth while the pipe is in service. The number of parts of the pipe has been reduced to a minimum to adapt them for quick separation.

WAISTBAND.—MOSES W. WINSTON, Manhattan, N. Y. The invention relates particularly to improvements in attachments to waistbands for boys' trousers; and the object is to provide suspending attachments adapted to be engaged with buttons or with the buttonholes of suspenders, these attachments consisting of metal and being, therefore, not apt to break, as is the case with the suspending devices made of tape or elastic.

STOVE-PANEL.—NIELS N. PETERSON, Milwaukee, Wis. When a panel is made in a single section or in sections joined together, it soon becomes warped by the heat and practically useless because vessels cannot sit level thereon. To obviate this warping, the stove panel is made of inner and outer sections, each consisting of two unconnected members, the joint or conjunction of two members of one section being at right angles to the joint or conjunction of the two members of the other section.

SPINNING-TOP.—RICHARD A. LANGERMAN, Louisville, Ky. The invention is an improvement in conical wooden tops spun by the unwinding of a cord or string. The wooden body of the top is provided with a metal cap or cover secured by a spike passing axially through the body, and constructed with a large conical head having a flat portion abutting the truncated head of the top body. The weight of the head of the spike places the center of gravity of the top comparatively low and serves to prevent the cracking or splitting of the body.

Designs.

STOVE BOARD.—EDWARD M. KEMP, Rhinelander, Wis. The distinguishing features of this design are a centerpiece, a border, and a background of peculiar form or ornamentation. The background is mosaic; the centerpiece is essentially a circular figure inclosing a smaller one formed of a series of overlapping rings. The border is double-lined and tesselated.

BLANK FOR SHOE UPPERS.—JOSEPH BRUNO, Haverhill, Mass. The leading feature of the design comprises a body having side flaps, tongues, and angular arms, all so arranged that they can be bent and sewn into proper position in the completed shoe.

GARMENT SUPPORTER JAW.—THOMAS F. MCCULLOUGH, Memphis, Tenn. The jaw has a concave serrated edge which runs into the serrated edge of an extension. The serrated edges serve the purpose of holding the garments securely.

EXHIBITING TRAY.—WALTER T. HATHAWAY, Brooklyn, N. Y. This tray has been especially designed for the purpose of exhibiting Colgate's soaps, and consists of a rectangular box in which is arranged a partition transversely inclined and provided with openings for the soap cakes.

MEMORIAL TABLET.—MYRON S. TELLER, Kingston, N. Y. The design represents a memorial tablet which is to be used as a commemorative monument to soldiers. The features of the design are, therefore, appropriate to the particular purpose for which the tablet is to be used.

WALL PAPER.—PERRY WEARNE, Rixheim, Alsace, Germany. The novel feature of this design consists of a medallion, a suspended wreath around the medallion, and a pendant carried by the wreath, all appearing between parallel stripes.

WALL PAPER.—PERRY WEARNE, Rixheim, Alsace, Germany. The design in its entirety consists in the representation of panels of fancy woodwork arranged parallel and intertwined by ivy.

WALL PAPER.—PERRY WEARNE, Rixheim, Alsace, Germany. The essential feature of this design is to be found in a garland of flowers in a panel surrounded by a border ornamented with scroll work.

WALL PAPER.—PERRY WEARNE, Rixheim, Alsace, Germany. A bamboo trellis and leaves intertwined therewith form the subject of the present design for wall paper.

WALL PAPER BORDER.—PERRY WEARNE, Rixheim, Alsace, Germany. In this border roses are interlaced with ribbons crossing each other.

LAMP-SHADE.—HARRISON D. MCFADDEN, East Orange, N. J. The lamp-shade has a flaring body with bands at the top and bottom, between which the body is plaited. The top and bottom bands are connected at intervals by straps giving the complete shade a paneled effect.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 1783.—For parties to make porcelain, sparking plugs for gas engine ignition.

For mining engines. J. S. Mundy, Newark, N. J.

Inquiry No. 1784.—For a spring power for running peanut roaster; motor to be about ½ to ¾ horse power.

"C. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 1785.—Wanted, to purchase patents on articles suitable for general consumption, such as noveities, etc.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 1786.—For a cardboard match scratcher with space for advertising thereon.

Stencil Machines.—A. J. Bradley, 101 Beekman St. N.Y.

Inquiry No. 1787.—For manufacturers of canning machinery.

Gasoline Lamps and Systems. Turner Brass Works, Chicago.

Inquiry No. 1788.—For machines for printing names on aluminium tags.

Machine chain of all kinds. A. H. Bliss & Co. North Attleboro, Mass.

Inquiry No. 1789.—For a double crank forging, cranks to be 180 degrees apart and 4 inches stroke, for a double cylinder gas engine.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 1790.—For manufacturers of water fountains, etc., for lawns.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 1791.—For parties dealing in small armature punchings in large or small quantities.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 1792.—For castings for small gasoline engines.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 1793.—For the necessary apparatus for establishing a "Shoot the Chutes" resort.

CANS.—¼ pint and ½ pint tin cans are manufactured by National Cement Co., Toledo, O. Write for prices.

Inquiry No. 1794.—For a machine for painting board fence signs.

Machinery designed and constructed. Gear cutting. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N.Y.

Inquiry No. 1795.—For dealers in carbonized papers.

Manufacturers of patent articles, dies, stamping, tools, light machinery. Quadrigs Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 1796.—For manufacturers of brass and aluminium castings for small model engines.

Constructor and operator of wood chemical plants, including refineries and by-product apparatus. O. A. Myers, 626 West Fourth Street, Cincinnati, Ohio.

Inquiry No. 1797.—For manufacturers of boxes and crates.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 1798.—For dealers in magnetized steel.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 1799.—For manufacturers of rubber figures, such as men, boys, etc.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 1800.—For manufacturers of hard rubber goods.

WANTED—Patent articles of merit to manufacture and place on the market. Will buy or pay royalty. Give full particulars. Address Sidney Folder Co., Sidney, Ohio.

Inquiry No. 1801.—For a machine for sandblasting buttons.

WANTED.—A practical mechanical engineer of good executive ability in a large textile manufacturing company. State age, experience and references. Engineer, Box 773, New York.

Inquiry No. 1802.—For manufacturers of locked-rubber floor covering and machinery for making the same.

FOR SALE AT A BARGAIN.—100 tons 65 lb. steel girder relaying rails, 30 feet lengths. Wheelock twin high-pressure engines, 24 x 48 cylinders, A1 condition. M. Braudy & Sons, Grand Rapids, Mich.

Inquiry No. 1803.—For a patented article for general use that can be manufactured in the south.

WANTED.—Experienced draughtsman on mill machinery and machine tools. Permanent employment assured to rapid and accurate draughtsman. Bethlehem Steel Company, South Bethlehem, Pa.

Inquiry No. 1804.—For manufacturers of centrifugal pumps for raising water for irrigating purposes.

WANTED.—First-class mechanic, thoroughly familiar with, and capable of keeping in repair, engines, boilers, pumps and all labor-saving devices in use by general contractors. Apply with references to Mechanic, P. O. Box 773, New York.

Inquiry No. 1805.—For manufacturers of water wheels.

The Excelsior Machinery Co., of 25 Whitecross Street, London, England, proprietors of inventions in special machinery, are prepared to develop, exploit and negotiate the sale of patented inventions, protected in Great Britain and Europe, also open to undertake the exhibit and sale of any class of machinery; having spacious warehouse and showroom accommodation with power, etc.

Inquiry No. 1806.—For manufacturers of hard or spring aluminium.

EXPERIMENTAL MACHINE SHOP.—We are not using our shop at present. Well equipped with lathes, shaper, woodworking machinery, etc. Will rent use and power very low. Fine place for automobile work. Billings Clapp Co., Boston, Mass.

Inquiry No. 1807.—For manufacturers or dealers in spring or clock motors.

Inquiry No. 1808.—For manufacturers of hot water heaters for boilers.

Inquiry No. 1809.—For materials used in boat building.

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Copies, apparatus for automatically producing and unlimited number of, F. E. P. Ehrlich ... 688,839
Corn cutter, sheller, and husker, combined, H. F. Diercks ... 689,008
Counter, J. F. Skirrow ... 688,977
Coupling manufacturing machine, D. A. Larkin ... 689,203
Cow tail holder, H. F. Beaty ... 689,033
Crane, vertical charging, C. L. Taylor ... 689,372
Crate, collapsible, W. A. Gold ... 689,046
Crossing signal, quadruple relay, B. N. Parrish ... 688,904
Crusher, W. E. Johnson ... 689,300
Cultivating machine, orchard, W. H. Lyman ... 688,958
Cultivator, H. E. Irwin ... 689,087
Cultivator, W. H. Sheridan ... 689,235
Cultivator, W. S. Graham ... 689,302
Cultivator, E. Haiman ... 689,350
Cultivator fender attachment, W. McKinnon ... 688,877
Cultivator, sulky, J. M. Donaldson ... 688,937
Cultivator, wheel, F. Bateman ... 689,155
Cultivators, operating and adjusting means for, E. Haiman ... 689,358
Cup. See drinking cup.
Curb, metallic, J. N. Harrison ... 688,851
Current meter, alternating, K. O. F. Schrottke ... 689,130
Curtain fixture, R. Caspar ... 689,038
Curtain fixture, Keeler & Duncan ... 689,195
Curtain pole and shade roller supporting bracket, combined, Johnson & Roberts ... 688,954
Cutlery, table, I. Hirsch ... 689,040
Cutting device, disappearing, E. M. Stone ... 689,331
Cutting off and dowel socket boring or tenon forming machine, F. F. Brainard ... 689,035
Cyanid solutions, regenerating waste, W. Orr ... 689,017
Cyanids, recovering, W. Orr ... 689,018
Damper, stove, F. H. Beecher ... 688,920
Dental tool, Seeger & Dedrick, reissue ... 11,956
Desk and seat, combined school, C. L. Neuendorff ... 688,878
Disinfecting apparatus, W. L. Mitchell ... 689,107
Disinfecting cloth and making same, A. Just ... 688,859
Display card, F. W. Hallock ... 688,997
Display lid, box, J. A. Krueger ... 689,315
Door check, L. E. Anderson ... 689,152
Door retainer, W. J. Smith ... 689,238
Draft appliance, P. M. Gutlebar ... 688,950
Draft equalizer, J. Latourell ... 688,868
Draft regulator, J. H. Diehl ... 688,836
Drawer guide, bureau or other, Kinnear & Jonah ... 689,095
Drinking cup for poultry, T. Kelly ... 688,862
Dust pan, C. Benham ... 689,156
Dust pan, W. E. Kelly ... 689,312
Dye and making same, basic red violet, F. Runkel ... 689,025
Dye and making same, brown sulfur, C. Ris ... 688,885
Dye, blue, H. Polikier ... 688,967
Dye, blue acid, H. Polikier ... 688,966
Dyeing on the fiber, B. Heymann ... 688,999
Electric carriers, speed regulating device for overhead, A. S. Cliff ... 688,828
Electric circuits, apparatus for locating faults in, T. W. Varley ... 689,254
Electric conduit box, interior, J. H. Stabley ... 689,139
Electric conduit boxes, cover for interior, J. H. Stabley ... 689,138
Electric conduit terminal, W. F. Bossert ... 689,278
Electric furnace, C. A. Keller ... 688,861
Electric heater, E. E. Gold ... 688,995
Electric lock, H. Seewald ... 689,133
Electric switch, automatic, A. H. Adams ... 688,982
Electrical apparatus, T. B. Kinraide ... 689,096
Electrical circuits, locating faults in, T. W. Varley ... 689,253
Electrical conduits, junction box for, R. M. Thomas ... 689,335
Electrical distribution system, protective mechanism for, R. V. Cheatham ... 689,353
Electricity, composition of matter as a non-conductor of, J. M. Ancira ... 688,813
Electrode, T. B. Kinraide ... 689,799
Electrostatic instrument, G. L. Addenbrooke ... 688,919
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Elevator, L. C. Babcock ... 688,983
Emery wheel cone grinding attachment, G. L. Jones ... 689,192
End gate and shoveling board, wagon, J. F. Hughes ... 689,310
Engine igniter, gas, J. Eckhard ... 688,938
Engine reverse gear, S. Kinscella ... 689,315
Envelope for addressing, means for attaching, M. H. Fried ... 689,208
Exhibitor, fabric, G. L. Heyman ... 688,853
Eyeglass nose clip, D. E. Weston ... 689,262
Eyelet, I. F. Peck ... 689,221
Eyeletting machine, I. F. Peck ... 689,222
Fabrics faced or coated with finely comminuted materials, manufacture of, H. Marius ... 689,320
Fan, suspended rotary, R. Lamb ... 689,098
Felly sawing machine, A. P. Harland ... 689,305
Fence, fabric, P. A. Reid ... 689,021
Fence post, H. B. Hiltpas ... 688,949
Fibers, treating cocoa or like, W. H. L. Alfred ... 689,052
Fife, L. C. McNeal ... 689,212
File box or case, W. S. Grange ... 689,076
Filter, E. S. Hermes ... 689,307
Firearm, automatic, J. M. Browning ... 689,283
Firearm, revolving, D. B. Wesson ... 689,200
Fire check, safety, C. M. Kemp ... 688,863
Fire kindler, J. H. Wallis ... 688,906
Fireproof roof, etc., E. L. Heidenreich ... 689,081
Fish plate, A. M. Wilson ... 689,270
Fish trap, W. J. Inman ... 689,086
Flagpole halyard attachment, G. M. Griffith ... 689,077
Flash light apparatus, A. Hemsley ... 689,048
Floor beam framing machine, C. L. A. Doeppe ... 689,169
Flush tank and means for operating same, F. & F. H. Engelhard ... 688,942
Foot, device for supporting the under part of the, J. S. Howkins ... 689,080
Frames. See Picture frames.
Furnace, E. Garfield ... 688,845
Furnace, H. F. Brown ... 689,032
Furnace door opening device, A. Hazelton ... 689,185
Furniture rack, F. T. Dirksen ... 688,837
Game apparatus, chess, P. G. Toepfer ... 688,900
Game board, W. H. Snyder ... 689,137
Games of chance, machine for playing, G. McMullen ... 689,365
Garment hanger, H. A. Wright ... 688,916
Garment supporter, H. R. Barry ... 689,274
Gas engine, M. F. Bates ... 689,351
Gas from water and oil, device for separating, Newbold & Lowry ... 689,366
Gas generator, acetylene, W. C. Homan ... 688,951
Gas generator, acetylene, P. Margulies ... 689,101
Gas generator, acetylene, R. F. Carter ... 689,163
Gas igniter, A. Martini ... 689,103
Gas igniting device, automatic, A. Martini ... 689,102
Gas, purifying, E. Theisen ... 689,246
Gear adjusting device, friction, C. A. & O. W. Hult ... 689,003
Glass articles, making hollow, Blair & Hays ... 688,923
Glass articles, manufacturing hollow, Blair & Hays ... 688,924
Glass, leer for annealing plate, J. Schubert ... 689,233
Glass, making corrugated, C. C. Harting ... 689,047
Glass polishing apparatus, L. H. Delbyre ... 689,041
Grain elevator, portable, W. Watts ... 688,912
Granitoid walk laying machine, J. T. Demsey ... 688,986
Granular material, apparatus for handling, A. Smith ... 689,029
Graphophone, M. S. Ragsdale ... 689,124
Gravity lock, L. L. Garside ... 689,177
Green house, conservatory, or other glass structure, W. Sefton ... 689,134
Grinder, edging or other refuse, E. E. Thomas ... 689,144
Grinding mill, Berchs & Chapman ... 689,034
Grinding mill and conveyor, R. Griffiths ... 688,849
Grinding mill, ball, F. Hundeshagen ... 689,347
Grinding plates, belt connection for, D. E. Moran ... 689,109
Halter square and chin strap buckle, combined, W. P. Fishback ... 688,990
Hammock, water, C. L. Fruden ... 689,020
Harness, F. M. Hunt ... 689,191
Harness, A. J. Wilde ... 689,208
Harvester cutting apparatus, A. V. Perrine et al. ... 689,116
Harvester, grain, W. N. Whitely ... 688,913
Hat and coat rack, C. H. Bolter ... 688,925
Hat curling machine, W. J. McGall ... 688,875
Hay raking apparatus, H. Grimm ... 688,848
Head rest, J. R. Kirk ... 689,097
Hearses, weather joint for, W. A. Roe ... 689,228
Heat generator, M. W. Grace et al. ... 688,846
Heating apparatus, gas, E. W. T. Richmond ... 688,883
Hemming gage, M. A. Colton ... 689,354
High or low water alarm, G. E. Turner ... 688,902
Hinge, W. Koester ... 689,201
Hinge, spring, C. S. Locke ... 688,957
Hoe, W. L. Mitchell ... 688,959
Heist, pneumatic, G. F. Steedman ... 689,140
Horn, reed or dinner, J. E. Spafford ... 689,330
Horseshoe, T. Conway ... 689,288
Hose tongs, J. A. Britton ... 689,059
Hose washer, J. A. Britton ... 689,060
Hot air furnace, W. P. Hartford ... 689,078
House moving device, C. McDonner ... 689,363
Hub, C. D. Revenoc ... 689,308
Hub, wheel, A. Patnode ... 689,019
Human body, apparatus for examining cavities in the, S. R. Crane ... 688,935
Hydraulic motor, J. H. Snow ... 689,329
Ice cream disher, A. B. Rush ... 689,368
Ice cream, vessel or can for storing or transporting, W. Kestenbaum ... 689,093
Ice cutting machine, Butler & Hammond ... 689,064
Induction coil, D. H. Wilson ... 688,815
Inhaler, S. M. Kenan ... 688,864
Insulator, Duffy & Hershey ... 689,171
Insulator, electrical, A. F. Parks ... 689,218
Internal combustion engine, H. F. Wallmann ... 688,907
Ironing table, D. W. Paige ... 688,880
Jar, A. H. Doty ... 688,988
Journal box, J. Frey ... 688,842
Knife handle, E. F. Shaw ... 689,135
Knob and alarm bell, combined door, P. C. Plaster ... 689,322
Labeling machine, E. T. McKaig ... 688,876
Lace guard, M. Dutel ... 689,042
Lacing attachment, J. C. Telfer ... 689,245
Lamp, A. L. Olsen ... 688,113
Lamp, acetylene gas, A. L. Buffington ... 688,926
Lamp burner, W. W. Seeley ... 688,973
Lamp, electric arc, C. Eschwei ... 689,356
Lamp, flash light, A. C. Loker ... 689,319
Latch, J. Couture ... 688,934
Latch, W. H. Taylor ... 689,334
Latch, sliding door, H. L. Ferris ... 689,074
Lathe, turning and boring, G. A. Ensign ... 689,071
Level, plumb, J. H. Quimby ... 689,323
Lightning conductors, earth conductors for, F. Immich ... 688,855
Limb, artificial, D. Dewell ... 688,936
Line spreader, Griswold & McAlpin ... 689,181
Linotype machine, multiple magazine, C. A. Albrecht ... 688,812
Liquid applying device, W. Wiggins ... 689,266
Liquids in definite proportions, machine for mixing, E. Zahm ... 688,980
Lock or latch, J. Couture ... 688,933
Locomotive tender spring jack, portable, L. W. Chase ... 688,824
Machine table feeding and guiding mechanism, E. C. Mershon ... 688,871
Machinery stop mechanism, J. R. Scott ... 688,889
Magnesium carbonate, making, F. S. Young ... 689,345
Mail bag crane bag holder, W. W. Emery ... 688,903
Make and break device, J. W. A. Kimmey ... 689,198
Manhole frame, F. C. Pillsbury ... 689,224
Match holder, Anderson & Hjerpe ... 689,053
Match machine, W. W. Abbott ... 688,811
Matches, making, P. Bergsoe ... 689,055
Measurements for tailoring purposes, taking photographic, G. Moe ... 689,361
Merry go round, D. B. Good ... 689,180
Metal bending machine, Gardiner & Ramsey ... 689,075
Metal blanks, regulating weight of, W. Johnson ... 688,857
Metal bolles, manufacture of hollow, J. B. Larkin ... 689,204
Metal cloth for purses, chatelaine bags, etc., R. Schoch ... 689,232
Metal plate bending machine, G. W. Green ... 688,996
Middlings purifier, G. Walter ... 689,257
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Milk can, E. C. Seaman ... 688,972
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Mineral substances by the selective action of oil, separating, A. S. Elmore ... 689,076
Miter box, B. H. Otis ... 688,879
Moistening substances, apparatus for automatically, R. Timm ... 689,248
Mole trap, S. B. & J. F. Rittenhouse ... 689,324
Monitor, canopy, R. F. Childress ... 689,165
Motion mechanism, reversible, W. K. Thomas ... 688,899
Motor starting device, E. P. Cowles ... 688,985
Music chart, F. F. Dawson ... 688,833
Music leaf turner, E. J. Moller ... 689,108
Music producing apparatus, E. R. Kleemlchen ... 688,896
Musical instrument soundboard, stringed, A. Springer ... 688,893
Neat, poultry, J. N. Gaudreau ... 688,944
Newspaper, magazine and book holder, A. H. Ballard ... 688,819
Nut lock, F. Freese ... 688,841
Nut lock, W. S. Kocher ... 688,867
Nut lock, H. J. Buell ... 689,036
Nut lock, J. H. Ferguson ... 689,073
Nut lock, G. H. Roberts, Sr. ... 689,126
Nut lock, Everett & Harris ... 689,173
Oil can, M. Masterson ... 689,208
Optical instruments for measuring the distance between the eyes, E. Donitz ... 688,987
Orange cleaning and grading machine, W. Jacobs ... 689,089
Ore concentrator, H. Unicker ... 689,252
Packing device for shaft bearings, U. J. Van Bergen ... 689,146
Pail, milk, A. F. Dildot ... 689,293
Painting machine, barrel, C. G. Wieland ... 689,265
Pancreas enzymes with heavy metal and obtaining same, compound of, W. Weber ... 689,149
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Peeler and corer, apple, H. Warner ... 688,909
Pen, T. J. Deck ... 688,834
Pen case for holding pens, J. C. Hill ... 689,309
Pencil sharpener, D. R. Phillips ... 689,223
Phonograph, W. Peisker ... 688,905
Phonographs, duplicate sound record cylinder for, A. N. Petit ... 689,117
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Photo display cabinet, A. T. Liddholm ... 689,011
Photographic developing paper holder, E. A. Gilbert ... 689,300
Photographic films, covering rollers with, E. Rolffs ... 689,230
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Piano backs, apparatus for assisting in making, C. H. Broman ... 689,061
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Pipe for sewers, etc., A. L. Jones ... 689,091
Pipe wrench, F. B. Sands ... 689,325
Pistol, liquid, R. Parker ... 688,882
Placket closure, J. M. Ulsh ... 689,250
Plane, S. R. & A. E. Rust ... 688,900
Planter and drill, J. H. Elward ... 688,940
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Plow gage, W. H. Wilson ... 689,340
Plumb, C. D. Janssen ... 688,952
Plumber's fitting, Fruin & Walker ... 689,045
Pneumatic despatch tube system, E. A. Fordyce ... 689,043
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Pole tip buffer or guard, carriage, E. G. Johnson ... 688,856
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Propelling mechanism, S. D. Hobson ... 689,050
Pulley lubricator, loose, F. J. Rippl ... 688,884
Pulp engine, W. N. Sherwood ... 688,976
Pump, differential, E. M. Coryell ... 689,035
Punching bag platform, Yoerger & Schwegler ... 689,344
Punching machine feeding mechanism, W. F. Siegener ... 689,136
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Purse or bag frame, A. F. Fuller ... 688,992
Rail chair and joint, B. H. Tripp ... 688,901
Rail cleaner, A. Rom ... 689,024
Rail frog, continuous, E. S. Eberlein ... 689,286
Rail joint bridge plate, F. E. Abbott ... 689,151
Rail systems, mechanism for raising contact shoes on third, S. H. Libby ... 688,869
Railway, electric, Bingham & Schlechtiger ... 688,922
Railway switch, G. L. Warren ... 689,374
Railway tie and fastener, metallic, T. F. Mason ... 689,207
Railway tie and means for securing track rails to same, metallic, C. Buhrer ... 689,160
Railway tie plate, J. W. Stephenson ... 689,030
Receptacle or crate, W. O. Anderson ... 689,153
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Rotary engine, J. J. Unbehend ... 689,251
Rubber belt and manufacturing same, Berstorff & Meyer ... 689,157
Rudder brake, J. S. W. Grenfell ... 688,847
Sad iron, R. F. Collins ... 689,288
Sash attachment, window, I. E. Tranter ... 689,249
Sash pull and safety guard, combined, F. A. Chandler ... 689,287
Saw mills, log loader and stop for double cutting band, E. E. Thomas ... 689,143
Saw set, S. Haltom ... 689,304
Saw setting machine, W. L. Holcomb ... 689,084
Sawing apparatus, F. Linquist ... 689,013
Scale, O. O. Ozias ... 688,993
Scoop board, A. N. Jordan ... 688,858
Scuttle, J. Formes ... 689,044
Seal, car, J. H. De May ... 688,835
Seal, car, S. F. Estell ... 689,172
Seal, car, Peirce & Foote ... 689,225
Seed hull press, cotton, W. P. Williams ... 689,269
Semaphore operating device, J. Shoecraft ... 688,891
Separable ring, Kellogg & Vale ... 689,196
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Sewing machine, hemstitch, A. J. A. Oesterreich ... 689,112
Sewing machine presser bar clamping mechanism, R. G. Woodward ... 689,375
Sewing machine spool holder and tension device combined, A. I. Jacobs ... 689,089
Sewing machine tension device, Quist & Wegelin ... 689,226
Sewing machine thread controlling mechanism, H. A. Klemm ... 689,200
Sewing machine thread cutting attachment, J. M. Glieckman ... 689,179
Sewing machine tuck folder, A. Laubscher ... 689,100
Shade adjusting device, window, J. H. Brown ... 689,282
Shade roller bracket, J. Wilson ... 689,339
Shafts or mandrels, device for fastening collars, pulleys, or the like on, A. E. Whitehouse ... 689,264
Sheet metal, corrugating, A. E. Brown ... 689,280
Sheet metal or material, dovetailed, A. E. Brown ... 689,281
Shutter operating device, window, E. L. Schwanengel ... 689,132
Sign supporting stand, S. L. Davis ... 688,832
Siphon, D. A. Kreider ... 689,006
Skeining or winding machine, J. H. Young ... 688,917
Skins, producing imitations of Crimean or Persian curl upon, S. Lewin ... 689,009
Sleeper, metallic, C. G. Vachon ... 688,904
Smoke consumer, R. Schulz ... 688,888
Smoke consuming and fuel saving device, A. Z. Germains ... 689,290
Soldering bottoms or tops of tin cans, etc., apparatus for, Besse & Lubin ... 689,056
Soldering iron, T. E. Lee ... 689,318
Sole trimming machine, E. E. Angell ... 688,815
Sound record and making same, E. Berliner ... 689,350
Sound records, apparatus for duplicating or multiplying, G. Bettini ... 688,921
Sound records, apparatus for producing, E. Berliner ... 689,349
Spinning spindle, W. G. Morrison ... 689,362
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Split machine, H. L. Beck ... 689,277
Spoke and felloe tightener, Drew & McReady ... 689,172
Spool stand, E. Schottenfels ... 688,887
Stacker, pneumatic, J. G. Taylor ... 688,897
Stamp mill, Parnall & Krause ... 689,219
Stamp, steam, E. S. Brett ... 689,279
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Stave jointing machine, J. P. Rust ... 689,026
Steam overheating apparatus, B. F. Bastiansen ... 689,276
Steel or iron sawing machine, cold, J. Hill ... 689,083
Steering engine, vessel, F. B. Turner ... 689,145
Stills, rectifier for spirit, R. Leyer ... 689,010
Stool, devotional, C. M. Dugan ... 689,295
Stop motion finger, C. L. Healey ... 689,306
Stove, gas, H. Adler ... 689,051
Stove, gasolene or gas, G. R. Moon ... 688,909
Stove generator, vapor, I. Kinsey ... 688,865
Stove or furnace, heating, E. J. Lansing ... 688,956
Stove or furnace, heating, O. P. Mason ... 689,104
Strop, swing, J. R. Torrey ... 688,978
Suit case clothes holding device, S. Kiefer ... 689,094
Swimming device, B. J. Hooper ... 689,085
Syringe nozzle, R. Parker ... 688,881
Teeth, fastening for artificial, A. Bischoff ... 689,158
Telephone cable fire protector, F. D. Saylor ... 688,970
Telephone system, selective, J. V. Stout ... 689,141
Telescope, water, W. M. Parrish ... 689,220
Templet for the manufacture of cuffs, etc., J. I. McDonald ... 688,961
Thill coupling, M. E. Covey ... 689,290
Thill coupling and detacher, G. H. Tatge ... 689,142
Thread cord, etc., finger device for cutting, J. H. Polhemus ... 689,122
Threshers, machine for rethreshing the tailings in, M. S. Bowers ... 688,823
Threshing machine, J. Lindner ... 689,012
Tie plate, J. N. Hayes ... 688,852
Time alarm, incased electric, A. P. Schloss ... 688,880
Time check, F. H. Gilson ... 688,301
Time switch, automatic electromagnetic, J. Sachs ... 689,128
Tire and means for securing it on wheels, wheel, P. W. Tillinghast ... 689,247
Tire, elastic, T. Gare ... 688,994
Tire repairing tool, B. J. Piquet ... 689,121
Tire, vehicle, E. C. & F. P. Whitaker ... 689,263
Toaster, wire, thread or other, Z. T. Hall ... 689,182
Torch, M. M. Carr ... 688,928
Torpedo, railway, M. M. Carr ... 688,930
Toy for playing at target marbles, E. Bauer ... 689,054
Trace hitcher, W. W. Meredith ... 689,105
Track layer's instrument, L. B. Clark ... 688,826
Traction wheel, G. A. Tauer ... 689,244
Tray holder, M. Holl ... 688,940
Trolley, T. McWilliams ... 689,321
Trolley catcher, C. B. Roberts ... 689,227
Tunnels, means for ventilating, Churchill & Wentworth ... 689,039
Type case, W. A. Watson ... 688,911
Type or matrices, apparatus for provisionally separating lines of, H. Rurg ... 688,928
Typewriting machine, C. H. Shepard ... 688,890
Umbrella, folding, J. M. Shaffer ... 688,974
Valve, automatic, W. J. Collins ... 688,830
Valve, boiler feeder, G. R. Ford ... 689,176
Valve, centrifugal machine, G. Engel ... 688,941
Valve for explosive engines, controlling, J. Walrath ... 688,908
Valve movement, steam engine, C. C. Worthington ... 689,284
Vegetable cutter, L. Ziegelmeyer ... 688,918
Vehicle, G. J. Quinsler ... 689,123
Vehicle brake, automatic, J. W. Rowe ... 688,968
Vehicle fender, W. A. McGuire ... 688,962
Vehicle front gear, C. G. Stretch, Jr. ... 688,894
Vehicle gear, H. F. Weeks ... 689,150
Vehicle gear, short turning, W. A. Koon ... 689,314
Vehicle, motor, F. F. Dorsey ... 688,878
Vehicle, motor, J. T. Hill ... 689,001, 689,002
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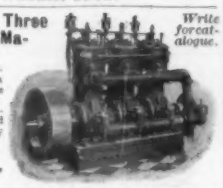

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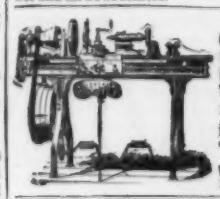

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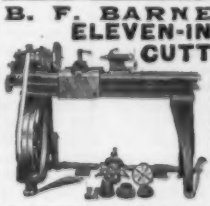

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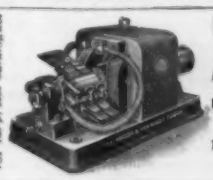

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(8480) F. S. N. asks: 1. Please inform me how many dry cells or batteries it requires to develop full brilliancy in a 16-candle power incandescent lamp? Is it best to run the batteries in series or in pairs with a central connection? A. It is not possible to light incandescent lamps from dry cells. They are not adapted for use continuously, but must rest after being in use for a very brief period. To light a lamp with a battery take as many cells as the voltage of one cell is contained in the voltage of the lamp. Dry cells have about 1.4 volts. If the lamp was rated for 54 volts, for example, 50 cells would be required to bring it to full brilliancy. They must be arranged in series. 2. Can you give me the directions for making a dynamo capable of lighting four incandescent lamps of 12 candle power each, power to run dynamo from dry batteries, and number of batteries required to run dynamo? A. SUPPLEMENT No. 600, price ten cents, gives the plans for building a dynamo which will light eight 16 candle lamps of 50 volts each. You cannot run a dynamo with a battery. You can run a motor with a battery, and use the motor to run a dynamo, but it would be at a great waste of power.

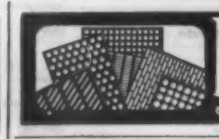
(8481) G. L. asks: 1. Have built a motor described in SCIENTIFIC AMERICAN of December 8 and 15 last. Can the same be run as a dynamo? If not, why? If so, how? A. The little motor can be run as a dynamo if you excite the field magnets by a battery. We doubt if it can excite its own fields, though you can try it after you have run it with a battery. 2. Also say whether enameled ware can be re-enameled after it chips off and commences to leak, and give receipt for same, with method of applying. A. We know of no way of repairing enameled goods.

(8482) J. D. asks: 1. Please tell me the composition of the heater on Nernst lamp; that is, what is this cement made of and what proportion? A. The Nernst lamp is described in the SCIENTIFIC AMERICAN for September 2, 1901, price ten cents, as it was exhibited at the Pan-American Exhibition. The proportions of the materials used in the filament are probably known only to the patentees. 2. What size platinum wire, length of wire 12 inches, must I use with a voltage of 110 to bring the wire up to a temperature of 1,000 deg. C.? A. Any size of wire can be heated to 1,000 deg. C. if you have current enough. The voltage of the current is not important except that it be sufficient to force the current through the wire. A low voltage would be better, since 12 inches of wire will have very little resistance, and you will require a rheostat, thus wasting current. 3. Give rule for finding current necessary to raise any size platinum wire to any temperature with any voltage. A. The heating power of a current is given by the formula $U = 0.24\ C^2Rt$ calories. C is amperes, R is ohms, and t is time in seconds. This will give the amount of water heated 1 deg. C. Divide this by the specific heat of platinum to obtain the weight of platinum which would be heated 1 deg. C. in the same time. 4. Tell composition of some good asbestos cement. A. Asbestos cement varies in composition according to the purpose to which it is to be applied. For boiler and pipe covering it is mixed with plaster of Paris with a very thin glue. For fire-resisting purposes it may be mixed with a small portion of fire clay.

(8483) H. B. asks: 1. Will the motor described in SUPPLEMENT for August 2, 1890, run on a 100-volt alternating circuit? A. No. It is a direct-current motor. 2. If not, what changes could be made so as to make it? A. We should not change it. We should take a different design. See "Electrical Designs," price $2 by mail, where there are several sizes of machines with plans and descriptions. 3. What horse power is the motor, and could this be doubled if everything else in the motor was also made twice as large? A. Perhaps a fifteenth to a tenth. The design is not adapted to a large machine.

(8484) C. L. G. asks: 1. Is it practical to use batteries for motors of small power, such as sewing machines, small lathes, etc.? A. Yes. 2. Could the Hopkins motor, described in SUPPLEMENT No. 641, be wound for power

(Continued on page 439)



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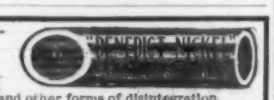

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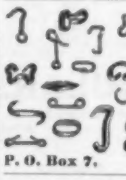

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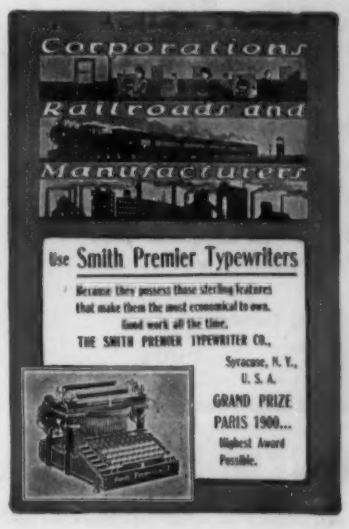
circuit and be used in series with incandescent lamps? A. Yes. 3. Please cite me to information of easily constructed electric motor of small power for power circuit. A. "Electrical Designs," price $2 by mail. 4. Can you cite me to information of easily constructed battery motor better than Hopkins motor mentioned above? A. No.

(8485) S. C. asks if it is proper to say that "the volt and ampere have no connection whatever"? A. We should hardly put it in that way. The volt is the unit of electrical pressure, or electromotive force. The ampere is the unit of intensity of current. The ampere is the ratio of the volts to the ohms. They have that connection with each other.

(8486) F. J. D. asks if it is necessary to have a permit to run a small steam launch, say 20 feet in length; also, if government inspection of same is required. A. No license or inspection is required for running a steam launch on waters not navigable by other vessels in regular commercial travel.

(8487) J. R. K. asks: 1. Can you tell me what causes the so-called back fire in a two-cycle gas engine? Also can you suggest a remedy? A. Back firing in gas engines is caused mostly by a misfire charge exhausted into the muffler or exhaust pipe, which fires at the next exhaust. The next charge after a misfire is always a stronger charge, by a less admixture of burned gas, and also through this condition makes an unusually strong impulse or kick of the engine. Perfection in the action of the igniter is the only remedy. 2. Why is it that a two-cycle engine does not run at so high a speed as a four-cycle one, or is there a way to make them so they will? A. The two-cycle type has far less time to draw in and compress a charge than the four-cycle type per revolution, which causes defective charging and misfire at high speeds. The later designed automobile two-cycle engines seem to have sufficient speed for all practical purposes. 3. Which is the stronger—a two or a four-cycle engine of the same cylinder and stroke dimension? Some claim the two-cycle is, but I have never seen a two-cycle which would develop anywhere near the power that is claimed for some of the small four-cycle bicycle and automobile engines of equal size; and as I notice that the two-cycle is not used very much for automobiles, I wonder if they really do develop more power, for the weight would be less. A. The difference in power for equal-sized cylinders in favor of the four-cycle type is probably due to the greater compression and its greater explosive power. 4. I tested an engine for the power, and would like to know if this would be all right to get it approximately, or near enough for ordinary business. Of course, to get it correct it would have to be considerable of a job. Here is what I did: I used a pulley 18 inches in diameter on the engine shaft, and put a brake on it with an arm to the scale, which was 38 1-6 inches from center of shaft to point of bearing on the scale, which would be a circumference of about 20 feet, and the engine made 500 revolutions per minute, and the pull was 6 pounds on the scales. 500 revs. × 20 feet circumference of pull × 6 pounds pull on scales ÷ 33,000 = 1.82 horse power about. Can you suggest a better way or a more simple one to get at it fairly correct? A. Your method of testing the actual power of the gas engine was correct. See SUPPLEMENT, No. 992, on the various methods of testing the actual power of engines, 10 cents mailed.

(8488) A. G. S. asks: 1. Have you a SUPPLEMENT telling how to make a simple construction yet effective 110-volt dynamo, with illustrations of the work and telling how to wind the magnets and the armature? Please tell the number of the SUPPLEMENT. How big would the dynamo have to be if it was series wound, according to the dimensions given in the SUPPLEMENT? A. SUPPLEMENTS 865 and 1210, price ten cents each, give plans of dynamos with descriptions. The dimensions of each are fully given in each paper. 2. Can you run incandescent lamps on the same circuit as an electric furnace? A. Yes. 3. How many volts does it take to run an electric stove? A. An electric stove may be run upon any voltage, though it becomes difficult to insulate for high voltages; 110 volts are very commonly used. 4. If a dynamo gives six volts running 1° steady, how many amperes and ohms will it have? A. No one can tell. The amperes must be measured with an ammeter, and the ohms can then be found by dividing the volts by the amperes. 5. Please name and explain the different ways in which dynamos are wound? A. Dynamos are series, shunt and compound wound, and if they are to furnish alternating current, they must be separately excited. These terms are explained in all textbooks of electricity. We can send you Thompson's "Elementary Lessons" for $1.40 by mail. 6. How many volts does it take to run a 1 horse power motor? A. Motors may be built for any voltage. If run upon an incandescent lighting circuit they are either 110 or 220 volts. If upon an alternating current they are wound for 52 or 104 volts. The amperes are found for each motor by dividing 746 by the voltage. 7. Could you run an automobile at a good rate of speed with a 1 horse power motor? A. No. 8. How many volts does it take to make a watt? A. A watt is the power given by a current of one ampere flowing with a pressure of one volt. See Thompson's book above referred to.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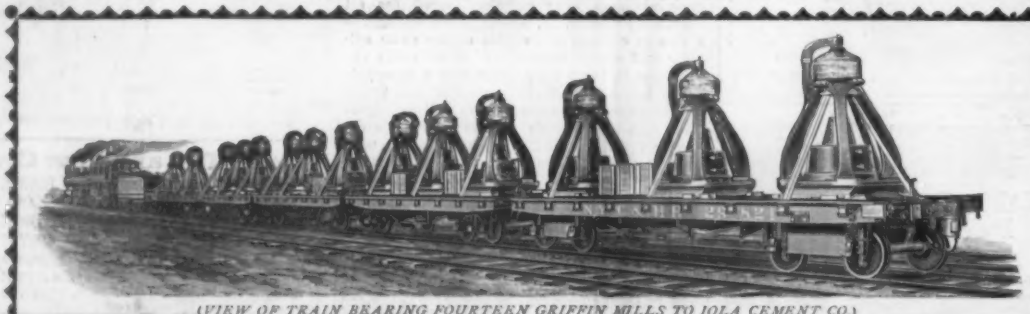

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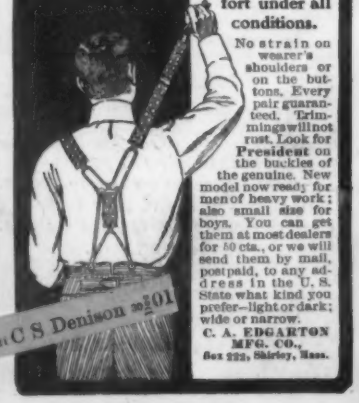
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